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INDEX

Case for Diagnosis and Treatment. By F. St. J. Steadman 2

Muscle Testing and Muscle Training. By E. Sheldon Friel 5

Prizes for Open Competition 28

Case of Partial Nasal Obstruction from 5-19 years of age. By F. Bocquet Bull 30

Expansion of the Upper Arch in a case in which only the Lower Arch is under Treatment. By Harold Chapman .. 32

Case of Absence of Premolar Teeth. By Edmund Claremont 32

Delay and Arrested Eruption. By Edmund Claremont .. 32

A Treated Case. By J. W. Mayer 34

A Very Pronounced Case of Class III. By C. S. Morris .. 35

Two Cases of Absence of All Eight Premolars. By J. H. Badcock 36a

Cases of Supernumerary Teeth in Indian Natives. By J. H. Badcock 36a

Cleft Palate Cases—Orthophonic Treatment. By Miss Elsie Nicholl, A.R.A.M. 36b

Cleft Palate Cases—Orthodontic Treatment. By William Ovey 36c

Congenital Absence of the Tongue. By Harold G. Watkin 37

Treated Case of Excessive Thumb-sucking. By Harold G. Watkin 38

Case of Deficiency of Teeth and Open Bite. By L. E. Claremont 38

Case of Post-normal Occlusion. By H. E. Marsh 45

Treatment of Incipient Angle's Class III. By G. Northcroft 45

Simple Method of Recording Facial Contour. By H. G. Watkin 45

Method of Making Molar Bands Direct to the Tooth. By Harold Chapman 46

Plain Retention Bands for Molars and Bicuspids. By C. S. Morris 46

A Treated Case. By L. F. Fouraker 47

Treatment of Incipient Angle's Class III. By Maxwell Stephens 47

Torsion : Some Facts and Probabilities. By J. W. Mayer 47

Distortion of the Maxillary Arch. By W. Warwick James 63

Deformity of the Maxilla Caused by Angeioma. By A. T. Pitts 63

Case of Congenital Absence of the Deciduous and Permanent Lower Central Incisors in four Members of a Family. By A. T. Pitts 64

Annual Reports and Balance Sheet 66

A Comparative Study of the Jaws and Occlusion of Maori and of British born in New Zealand. By Violet George 70

Case of Lip-sucking and its Treatment. By E. Sheldon Friel 76

List of Members of the Society 77

The British Society for the Study of Orthodontics.

An Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W., on Monday, January 21st, Mr. Sheldon Friel, President, in the chair.

Mr. A. Livingston, M.D.S., M.B., B.S.L'pool, King's College Hospital Medical School, S.E.5, was unanimously elected a member of the Society.

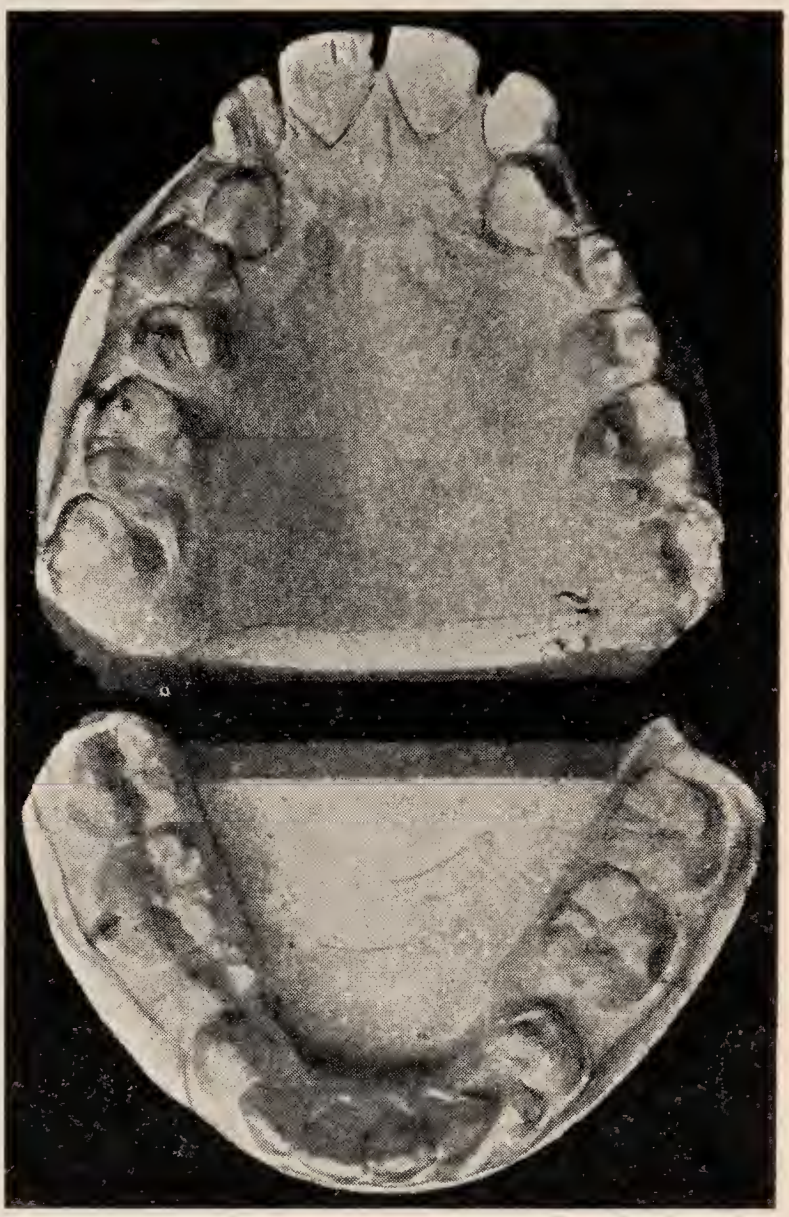
Casual Communication.

Mr. F. St. J. Steadman gave a Casual Communication, "Case for Diagnosis and Treatment." P. F. L. (age 17). This patient's mouth presents several unusual and interesting features. In the maxilla both canines have erupted internally, due apparently to the retention up to the age of 16 of the deciduous canines. While an instanding canine due to this cause is not uncommon, it is in my experience rare to find both in this malocclusion. In this case the left lower canine was also retained until a few weeks ago. In the maxilla there is a slight narrowing of the arch in the premolar region and there is a protrusion of the incisors. In the mandible there is considerable crowding which does not appear to be due to a lack of development, since the lower border of the mandible is apparently normal. The left lower second premolar is unable to erupt through lack of space. There is no history as to the fate of the right lower first premolar which is absent. The radiograms show a general sloping backwards of the front teeth, as though they have been thrust backwards and inwards, causing such a narrowing of the arch that the premolars bite inside the uppers. I consider that the position of the permanent molars is normal, both with regard to their position in the jaws and their occlusion. At first sight this irregularity of the lower teeth would appear to be partly accounted for by the loss or absence of the right lower premolar, but the same condition obtains on the left side, where both premolars are present. I can obtain no definite history of mouth-breathing or of habits. She had four or five teeth removed at the age of 8. It is possible that the right lower premolar was inadvertently lost at this time. It is interesting to speculate upon the cause of this condition. A powerful muscular action of the lower lip pushing the upper teeth forwards and the lower backwards after the early extraction of the deciduous teeth would be a feasible explanation. I am a believer in Sim Wallace's theory that the development of the jaws is due in part to the action of the tongue. In this case, however, there appears to be some force present which has been able to compress the lower arch in spite of the tongue action. It is interesting to note that the patient's general appearance is very much better than one would think likely from an examination of the models alone. I shall be glad to receive the opinion of members (1) as to the probable cause of this irregularity and (2) suggestions as to treatment.

Mr. Pitts said it was very difficult to come to any definite conclusion on a hasty examination of the case. He had formed the impression that it was a case of post-normal occlusion, and that although the lower molars appeared to be in their normal relationship that was because they had encroached on the space that should have been occupied by the second premolars which were not present in the arch. If the premolars had been present then the lower molars would have

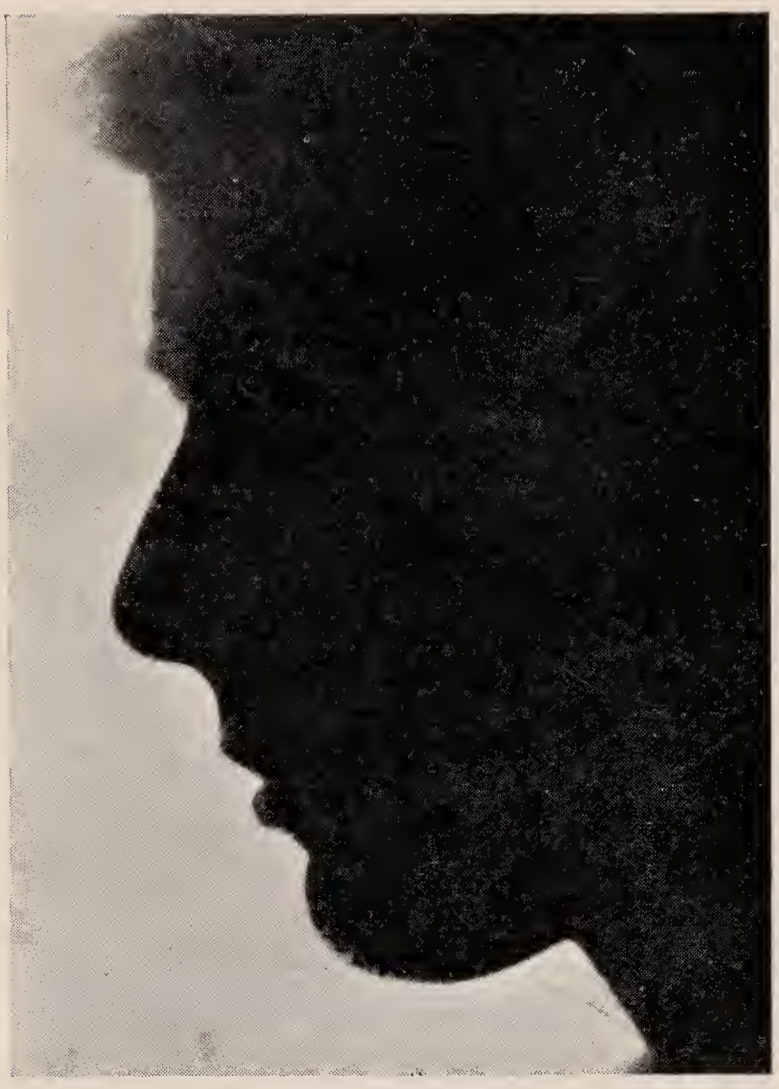
A CASE FOR DIAGNOSIS AND TREATMENT.

By S. F. St. J. Steadman, L.D.S., L.R.C.P., M.R.C.S.

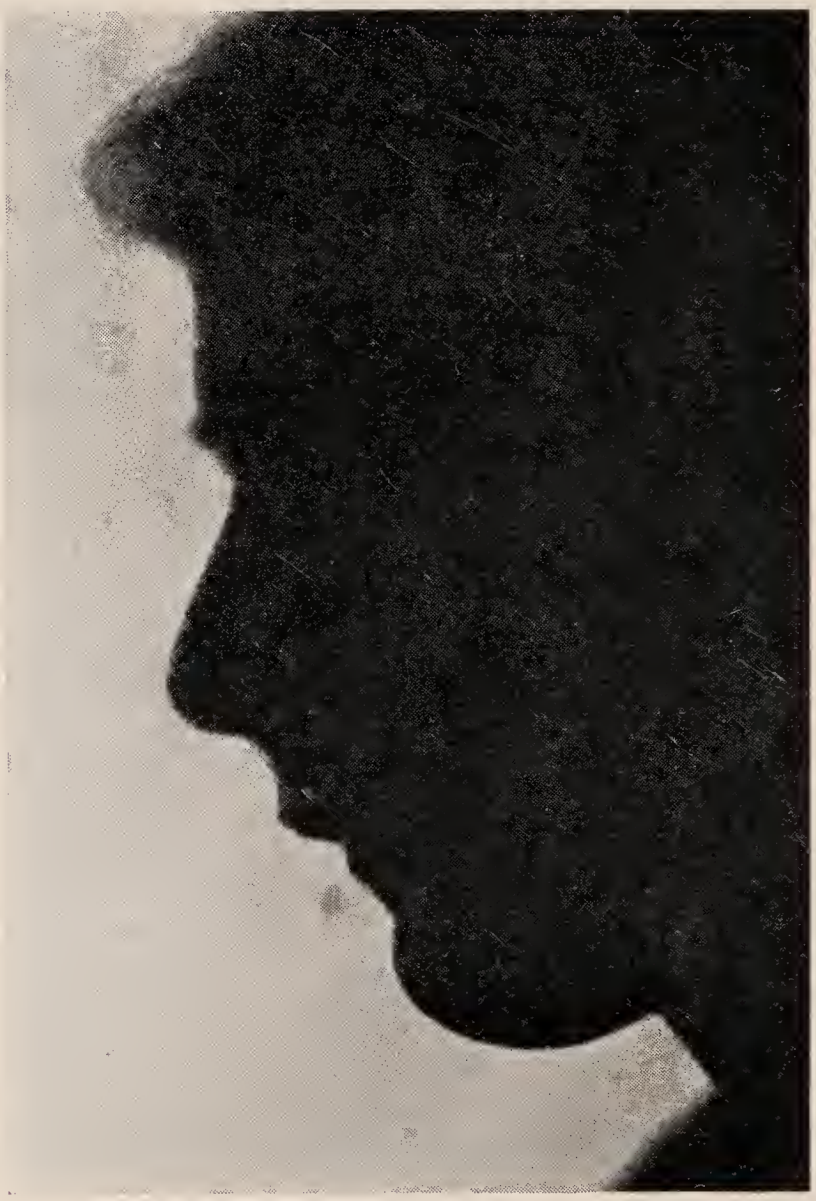


Left side of mandible.

Right side of mandible.



Forward.



Backward.

been in distal occlusion. Looking at the patient's profile, it had seemed to him that she did show evidence of mandibular retrusion, It had seemed to him, too, on looking at her and questioning her. that apparently she did get the lower lip underneath the upper incisors and that the protrusion of the upper incisors might be due to that fact. He noticed that she had that rather thickened pendulous appearance of the lower lip which all those Class 2 cases had, and that there was some degree of mouth-breathing, because the mandible being in retrusion it was only possible to close the mouth by a very distinct effort on the part of the lip. That had been the impression he had formed on rather a hasty examination of the case. With regard to treatment, the amount of mandibular retrusion, as judged by the profile, certainly was not so great as one might have gathered on looking at the models. Although he had asked the patient to put her jaw forward he was not prepared to say straight away that it did appear to be an improvement. It seemed to him perhaps that, since there was crowding—no room for the canines—the treatment might be not so much to try to advance the whole mandible by means of an inclined plane, as rather to advance the lower incisor teeth by means of an arch and to leave the molar teeth in their present occlusion. It was, however, very difficult to give a considered opinion on such a short examination, both as to diagnosis and treatment.

Mr. HAROLD CHAPMAN remarked that when he had seen the models in occlusion he had noticed that the lower incisors impinged on the soft tissues five or more millimetres behind the upper incisors, but the profile appearance did not correspond to that relation of the teeth which was shown by the models. He had therefore got the patient to bite, and she had occluded so that her lower incisors impinged on the cingulum of the upper incisors. He had returned to her after looking at the models again and had found, on asking her to bite, that she brought her teeth together as already described. But on asking her to bite back, she had immediately done so and in the position indicated by the models. In one instance the profile could not be taken great exception to, in the second instance it was extremely bad, and the lower incisors projected forward over the lower lip. To his mind the patient realised that she could improve her appearance by holding her lower jaw in that position, and was now doing so; so that he thought it was quite easy to have been misled as to the real occlusion by a casual examination. He agreed with Mr. Pitts' diagnosis as far as the molars went. They certainly had come forward owing probably to the early extraction of the deciduous molars or some caries. He would certainly move all the lower teeth forward and bring back the upper incisors as much as possible, and try to open the bite. He knew it was easy to talk like that, but that it was an extremely difficult thing to do. He inquired the age of the patient.

Mr. STEADMAN said the patient was 17 years old.

Mr. HAROLD CHAPMAN said he had seen a patient in a very similar condition that day, but almost worse, he thought: the facial appearance was certainly worse. That patient was $15\frac{1}{2}$ years of age. He had said that it was not a case which he would like to treat, nor one for which he would take any responsibility, and he desired to emphasise *that* in regard to this case now that he heard that Mr. Steadman's patient was 17 years old.

Mr. W. W. JAMES said it seemed to him that the lower incisors had been moved backwards probably by the action of the lip. He did not think that one ever saw the upper incisors protrude in such a manner as that exhibited by the patient without the lower lip having got beneath them. The actual condition of the mandible, he thought, was altered, and he should be inclined to think that the patient was and had been a mouth-breather. When the mandible was advanced so that the lower incisors bit on the cingulum of the maxillary incisors the correct position was assumed. The nose and the central portion

of the face was distinctly small, an appearance one often saw in mouth-breathers or in those who did not use the nose effectively. He believed that displacement of the mandible was due to the jaws being apart, so that air entered the mouth and the mandible was altered in its relationship to the maxillæ on account of the tissues suspended from it. He would certainly undertake treatment by opening the bite and endeavouring to raise the molars. He had done that in patients of the same age as Mr. Steadman's patient quite successfully. After the molars were raised he put on a mandibular arch and advanced the incisors. At one time he used to think that such treatment could not be successful in cases of such an age, but for the most part he had found it really did work quite well.

Mr. BADCOCK said the patient was 17 years of age and had got into the habit of holding her jaw in such a way that it did not present any deformity. He wondered, therefore, what good was going to be done her if she was put under any treatment.

Mr. STEADMAN said it was the overcrowding of the lower.

Mr. BADCOCK said from the point of view of appearance that did not do her much harm. Looking as well as she did, personally he would be very much inclined to let her alone. People with such a deformity did get into the way of holding their jaw forwards, so that ordinarily they looked quite well, but when they ate the jaw went back, and that was the only time when one really got their correct occlusion. Sitting and watching the patient, he had caught her off her guard once or twice, and then her jaw had been back and her lower lip was doubled up downwards so that it formed a very thick pad between her upper front teeth and her lower front teeth, which would be quite sufficient to cause what obviously had happened—the backward movement of the front teeth. The front teeth had moved backwards and the back teeth had moved forwards, in his opinion. With regard to treatment, personally he should be inclined to let the case alone.

Mr. STEADMAN thanked those speakers who had taken part in the discussion. Their remarks had given him much food for thought. He must think of what to do between the views of Mr. James and Mr. Badcock.

The President (Mr. Sheldon Friel) gave his inaugural address.

MUSCLE TESTING AND MUSCLE TRAINING.*

By E. Sheldon Friel, B.A., M.Dent.Sc.

President's Inaugural Address.

I should first like to thank you for the great honour which you have done me in electing me your President for this year. When I think of former Presidents, their achievements and their wide experience my heart fails me; but I shall do my best to maintain the dignity of the Chair, and hope that the support you have given to my predecessors you will also give to me.

The subject of my address is "Muscle Testing and Muscle Training."

The important bearing of muscular development on malocclusion and other dental malformations has become increasingly evident to those who practise orthodontics. During the last two years I have been carrying out some research amongst my patients and the children of two orphanages with a view to determining the effect of different groups of facial muscles on the arrangement of the teeth. All I can do to-night is to give you a short survey of what has been done in this field, the methods I have adopted and the results obtained. The number of children examined so far is too small to permit of any but very tentative deductions being made; nevertheless, I think some fresh light has been thrown on the part played by those muscles associated with the teeth and jaws in dental and facial development.

There is a very great difference of opinion among writers on the subject and not a little confusion of thought. I shall give you a few extracts, and you will, I think, see that in many respects the statements are contradictory, and in some instances there is scanty evidence in support of the theories put forward. Sir Arthur Keith in his "Antiquity of Man," writing of the overlapping bite of the incisors of modern European man in contradistinction to the prevalent edge-to-edge bite of the Anglo-Saxon period, says: "If ordinary chewing movements are made, those which grind the lower molar teeth against the upper and force the condyle of the lower jaw into the depth of its sockets in front of the ear passage, the temporal muscle will be felt to be strongly at work; it swells and subsides at each phase of the movement. When, however, a biting movement is carried out, one in which the edges of the lower incisors are made to meet the opposing edges of the upper incisors, the temporal muscle is felt to remain passive; the muscles which carry out this movement are the two which lie in the cheek—the masseter on the outer side of the ascending ramus of the mandible, and the internal pterygoid on its deep or buried aspect. In the inhabitants of our Western cities the biting mechanism has fallen into disuse. The overlapping incisor bite has appeared. The cheeks, which are high and prominent when the biting muscles—the masseter and internal pterygoid—are well developed, become reduced and sunken, giving us our narrow hatchet-shaped faces—our oval cast of countenance."[1]

Pickerill, in his "Prevention of Dental Caries and Oral Sepsis,"[2] seems to consider that the cause of narrow arches lies in the over-development of those pairs of muscles whose base at their origin

* *Proceedings* of the British Society for the Study of Orthodontics.

is shorter than the base of their insertion, as a result of eating tough food rather than hard food, so that there is more of a grinding than a crushing action. In other words, there is over-development of the pterygoids and consequent narrowing of the lower arch. Facts show this theory to be fallacious. The Eskimos and some North American Indian tribes probably perform the greatest pterygoid action of any race of people in chewing hides and lassoes in order to make them supple, and yet their arches are not narrow, but on the contrary broader than those found in the average European skull.[3]

On the basis of Pickerill's theory a greater bony attachment for the insertion of these muscles should appear in modern European than in primitive man, but this again is not the case. He overlooks the fact that the lower jaw is movable and that the pterygoids on each side do not contract fully at the same time.

J. F. Colyer,[4] writing about the influence of mastication and the relation of the muscles to the bones, says: "From these figures (referring to the deductions of Dr. Harry Campbell) it will be seen that the pterygoids, when in a state of contraction, must exercise an outward and backward tug on the external pterygoid plate, palate bone, body of the sphenoid and maxilla, and tend to pull them away from the sagittal plane of the head." He apparently considers that the upper arch is widened, Pickerill that the lower arch is narrowed by the action of the pterygoids.

Cryer, in his "Internal Anatomy of the Face," 2nd Ed.,[5] page 285, says, in describing one of his illustrations: "Should the mandible be compressed and a narrow dental arch exist, the tongue would be forced backward into the pharyngeal space, interfering with nasal respiration and other functions of the nasal cavity." On page 293, describing a frozen vertical section of the head, Fig. 303, he says: "The entire face is more or less compressed, especially the upper and lower jaws. The tongue has been forced out of shape by the pressure of the walls, showing that it had not sufficient power to force the alveolar process outward." It would appear from these quotations that Cryer considered that the dental arch controlled the shape and position of the tongue, instead of the tongue, a muscle, influencing the bone, a connective tissue structure.

Wallace, in his "Essay on Irregularities of the Teeth,"[6] written twenty-four years ago, holds that the tongue is one of the main factors in influencing the shape of the arch.

Johnson and Hatfield[7] have shown that the bite between the molars is very much less in cases of malocclusion than in children with normal arches.

These conflicting statements by men who claim to speak dogmatically on the subject show conclusively that the effect of the different muscles on the arrangement of the teeth is still a matter for research.

It seemed to me that the first step was to determine norms for the maximum pressure of different groups of muscles, the pressures being arrived at by the use of dynamometers; and to note the effects on the jaws and teeth where these groups of muscles, individually or collectively, varied from the normal. At the outset it was essential to decide what standard of comparison should be used for the different groups of children examined. Should it be age or size? To reckon the comparative strength of muscles the size of a child is clearly a more potent factor than his age,

especially when size is determined by the height of the trunk. The sitting height is now used very extensively as a standard for comparing weight, vital capacity, i.e. the maximum amount of air that can be voluntarily expelled from the lungs, and chest measurement in determining physical fitness. The tables for correlation of sitting height and weight may be found in "The Assessment of Physical Fitness," by G. Dreyer, Professor of Pathology at Oxford.[8]

In orthodontics it is of the greatest importance to determine, even in a rough and ready manner, whether the child under examination is physically fit. We cannot expect to find well-developed dental arches in a child who is physically unfit.

The instruments used in the examination were :—

Sitting height standard, Fig. 1.
Weighing-machine.
Smedley's adjustable handgrip dynamometer.
Gnatho-dynamometer (jaw).
Glosso-dynamometer (tongue).
Vertical Cheilo-dynamometer (lips).
Lateral Cheilo-dynamometer (lips).
Millimeter callipers.

The number of children examined were :—

75 boys at an orphanage.
30 girls at an orphanage.
95 boys and girls, all with malocclusion, in my private practice.

At least fifty children of each sitting height and of each sex would have to be examined before norms of real scientific value could be established. The norms, therefore, which I have adopted after the examination of so small a number of children must not

FIG. 1.—Method of taking sitting height suggested by Dreyer.

be looked upon as in any sense complete. This small number would inevitably have been much smaller (for these detailed examinations take time) were it not for the help received from Mrs. Sterling and Mr. O'Neill, Assistant Orthodontists at the

Dental Hospital, Dublin, Mr. McKeag of Belfast and Mr. Harold Chapman, to all of whom I am grateful for their valuable assistance.

The jaw pressure was taken between the upper and lower central incisors and between the first molars right and left (Fig. 2). It was found that the greatest pressure was exerted between the first molars and that the pressure between the second molars or second premolars was about 50 per cent. less. This bears out the opinion put forward by Prof. A. Thomson at the last meeting of this Society, that the facial bones in man are most strongly developed in line with the upper first molars. In this examination cases with marked caries of the first molars or loss of the first molars were not recorded.

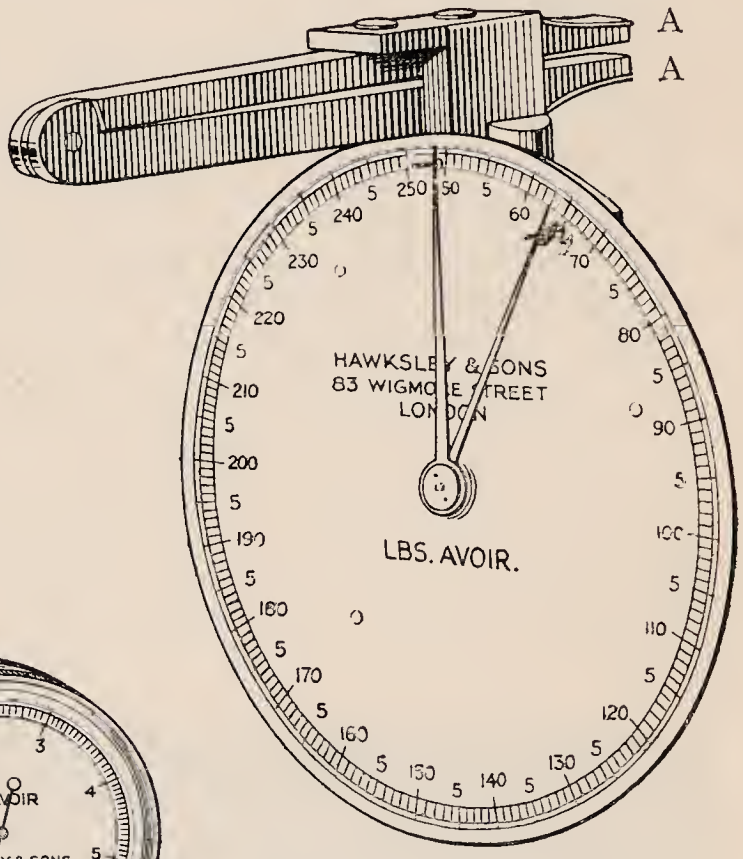


FIG. 2.—Gnathc-dynamometer. Lead or gutta-percha pads A and A′ cover the biting portion of instrument. New pads for each case.

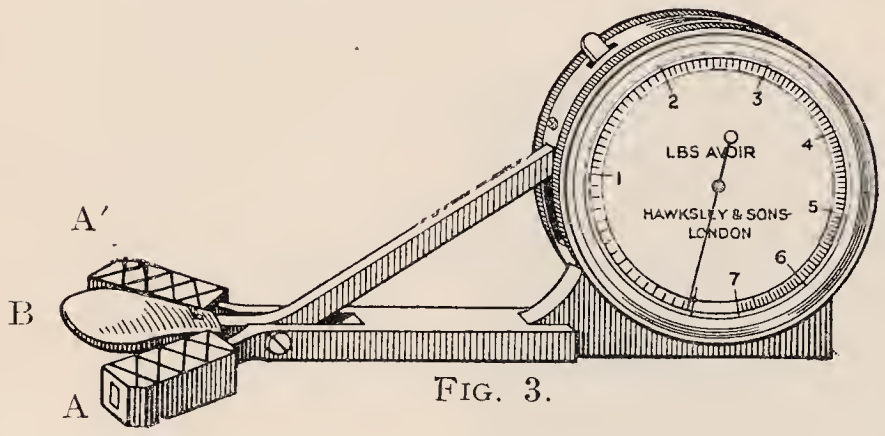


FIG. 3.

FIG. 3.—Glosso-dynamometer. Biting portions A and A′ held firmly between the teeth ; tongue pressed upwards and forwards against portion B.

In taking the tongue pressure the lower incisors impinged on the Glosso-dynamometer (Fig. 3) in the same position in each case under examination. Care has to be taken that the tongue piece is equi-distant from the right and left side of the palate, as otherwise it is inclined to strike the palate on the side nearest the instrument before the maximum pressure is recorded. During the use of the two lip dynamometers the teeth are kept closed (Figs. 4 and 5), and three trials of strength are given with each instrument. A considerable amount of encouragement has to be given to the child in order to obtain the maximum pressure with all these instruments.

The two graphs which follow are constructed from the results of the examination of 75 boys belonging to the same school and show the norms for the different muscle groups of children of different sitting height. In the first graph (Fig. 6) the average of molar pressure right and left and of incisor pressure and the averages of hand-grip right and left are given. As can be seen,

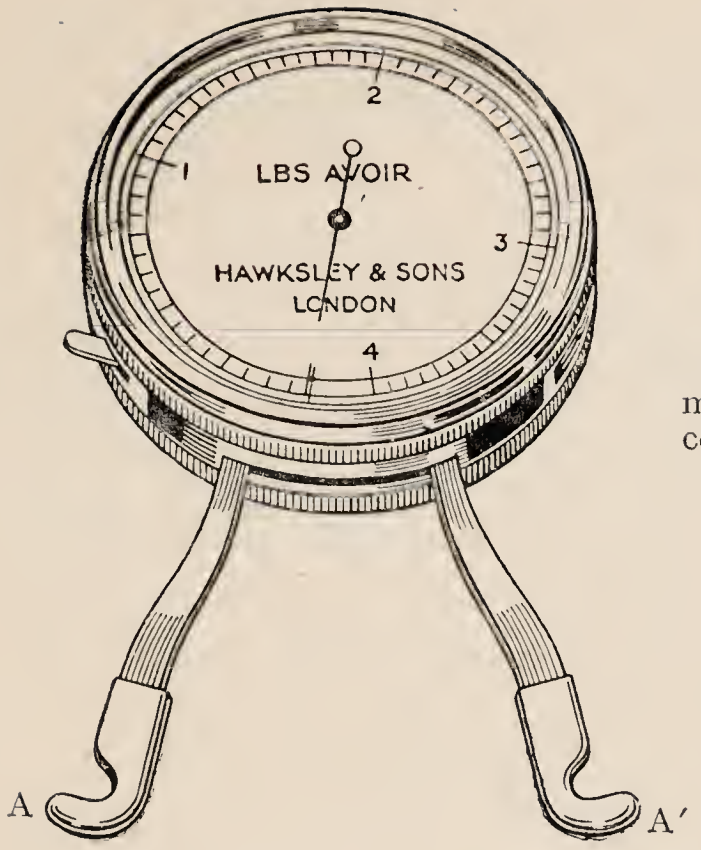


FIG. 4.—Lateral Cheilo-dynamometer. Lip portions A and A′ fit into corners of mouth.

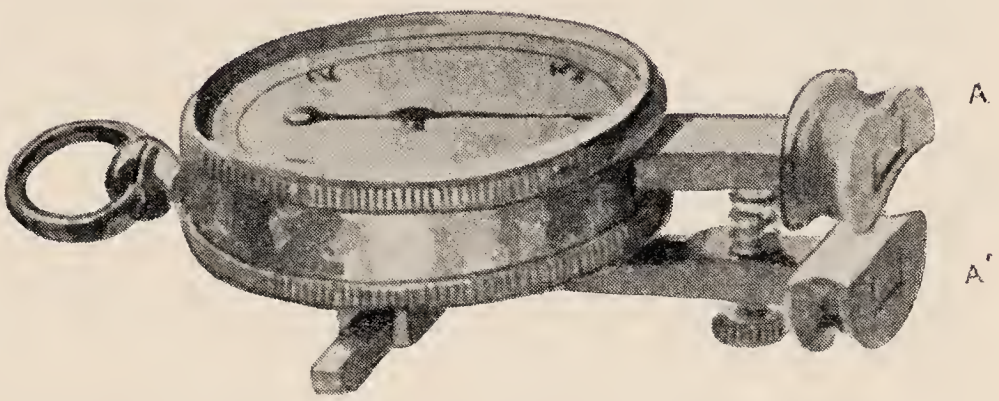


FIG. 5. — Vertical Cheilo-dynamometer Centre of lips fit on lip blocks A and A′.

there is a relation between these groups. This was also pointed out by Johnson and Hatfield in their examination in Boston, Mass.[7]

In the second graph (Fig. 7) are shown the curves made from the averages of tongue and lip pressure, vertical and horizontal. The curves are very slight, showing that in proportion to the increasing size of the child there is not relatively such a great increase in the strength of these muscle groups as in the capacity for jaw pressure.

I shall now show some individual cases emphasising the relation of muscle strength to the development of the jaws and arrangement of the teeth.

Fig. 8 shows the occlusal view of a boy with well-developed arches, normal occlusion and well-balanced muscles. (No. 47).

Fig. 9, side view of occlusion.

Fig. 10, front view.

MUSCLE TESTS. BOY—G. C. SCHOOL.
No. 47.

Age	Sitting Height. S.Ht.	Weight. Wt.	Right Hand-grip. R.Hg.	Left Hand-grip. L.Hg.	Incisor Pressure. I.P.	Right Molar Pressure. R.M.P.	Left Molar Pressure. L.M.P.	Tongue. T.	Vertical Lip. V.L.	Horizontal Lip-H.L.
13 yrs.	71.3 cm.	35.6 kg.	40 lbs.	34 lbs.	66 lbs.	158 lbs.	141 lbs.	$4\frac{12}{16}$ lbs.	$2\frac{15}{16}$ lbs.	$2\frac{14}{16}$ lbs.
Norms for 71 cm. Sitting Height.										
12 yrs. 10 mths.	—	32.5 kg.	45 lbs.	42 lbs.	50 lbs.	115 lbs.	102 lbs.	$3\frac{9}{16}$ lbs.	$2\frac{4}{16}$ lbs.	$2\frac{5}{16}$ lbs.

Fig. 11 shows the occlusal view of a girl also with well-developed arches and muscles. (No. 17).

Fig. 12, side view of occlusion.

Fig. 13, front view.

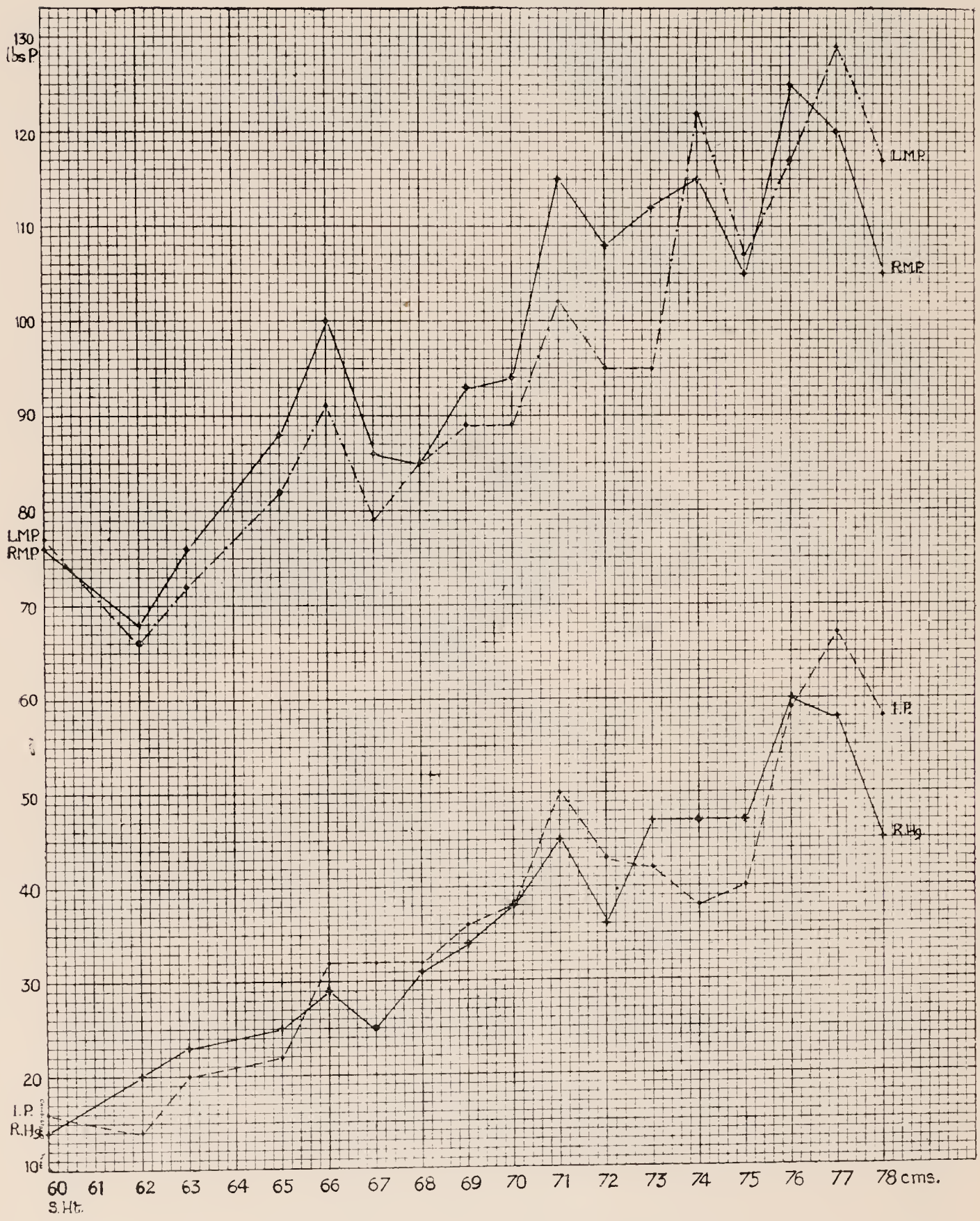


Fig. 6.—Graph showing averages of molar and incisor pressures and hand-grips for children of sitting heights from 60 cm. to 78 cm.

lbs.P. = lbs. Pressure.
L.M.P. = Left Molar Pressure.
R.M.P. = Right Molar Pressure.
I.P. = Incisor Pressure.
R.Hg. = Right Handgrip.
S.Ht. = Sitting Height.

S.Ht.

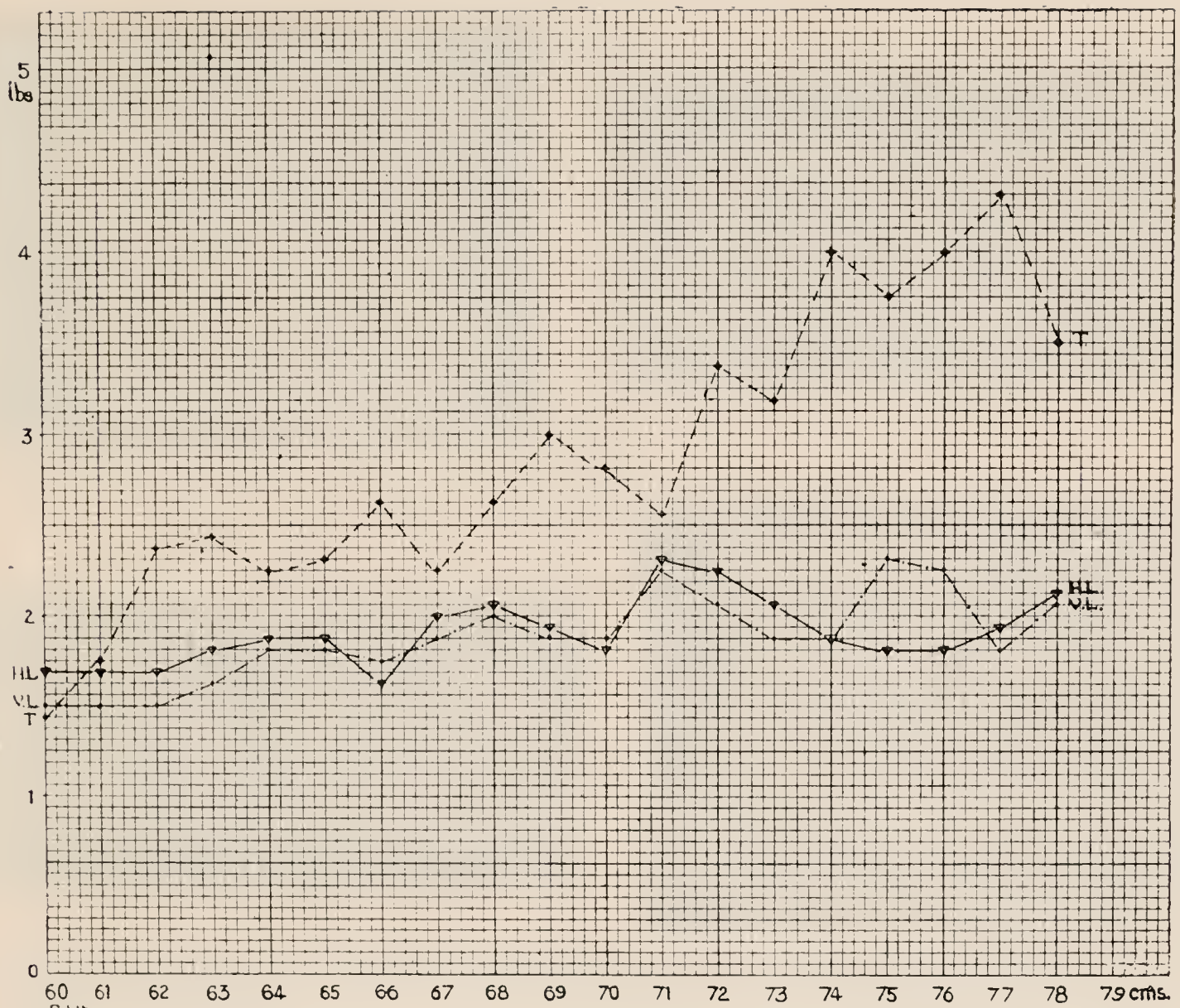


FIG. 7.—Graph showing tongue and lip pressures for same children as Fig. 6.

H.L. = Horizontal Lip.

V.L. = Vertical Lip.

T. = Tongue.

MUSCLE TESTS. E. HOME GIRL.
No. 17.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.L.
10 yrs. 8 mths.	75 cm.	49.9 kg.	31 lbs.	29 lbs.	38 lbs.	112 lbs.	128 lbs.	$3\frac{6}{16}$ lbs.	$2\frac{2}{16}$ lbs.	$1\frac{11}{16}$ lbs.
			Norms for 75 cm. Sitting Height.							
12 yrs. 8 mths.	—	40 kg.	42 lbs.	40 lbs.	45 lbs.	95 lbs.	112 lbs.	3 lbs.	$2\frac{3}{16}$ lbs.	$2\frac{4}{16}$ lbs.

The next two cases are both of girls whose physique is poor, poor dental arches and weak muscles. Both cases came to me in private practice.

MUSCLE TESTS. GIRL.
No. 490.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.L.
8 yrs. 2 mths.	70 cm.	28.6 kg.	25 lbs.	20 lbs.	12 lbs.	34 lbs.	52 lbs.	$1\frac{3}{16}$ lbs.	$1\frac{11}{16}$ lbs.	$2\frac{3}{16}$ lbs.
			Norms for 70 cm. Sitting Height.							
11 yrs.	—	31 kg.	30 lbs.	28 lbs.	30 lbs.	95 lbs.	87 lbs.	$3\frac{2}{16}$ lbs.	2 lbs.	$2\frac{1}{16}$ lbs.

Fig. 14, occlusal view. (No. 490.)

FIG. 8.

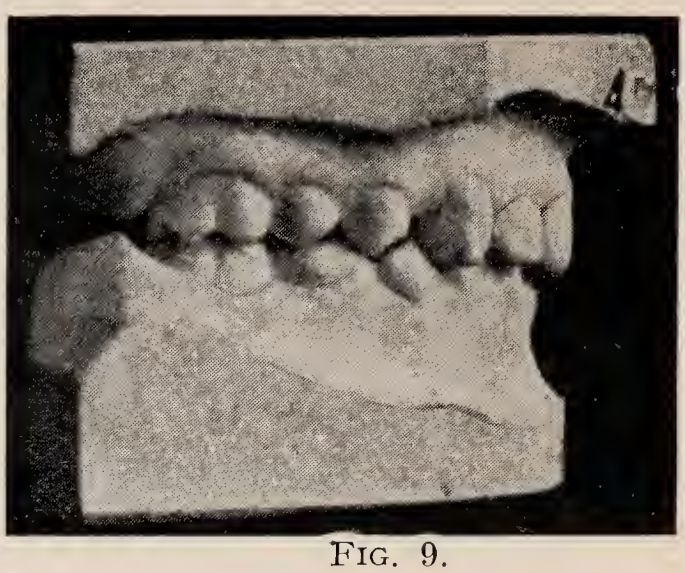


FIG. 9.

FIG. 10.

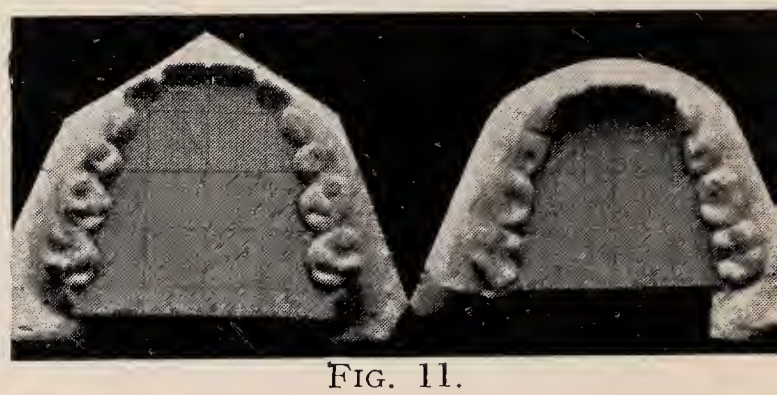


FIG. 11.

FIG. 12.

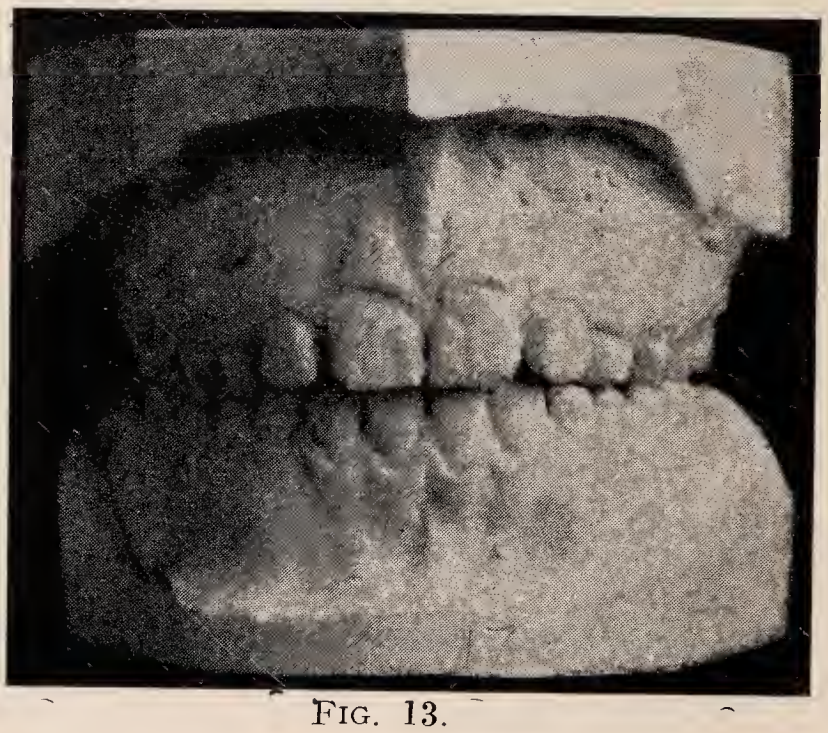


FIG. 13.

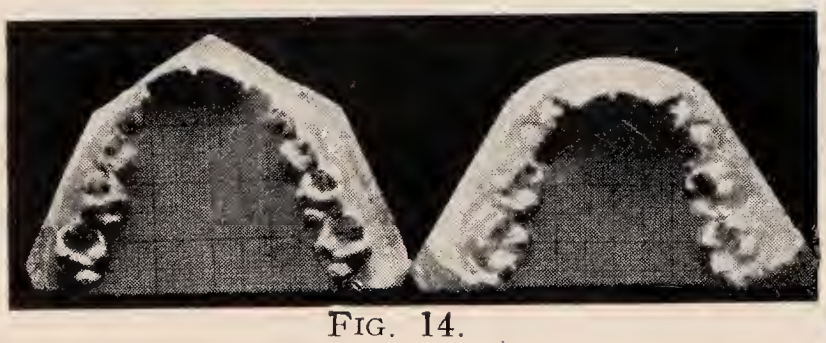


FIG. 14.

FIG. 15.

MUSCLE TESTS. GIRL.

No. 394.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.C.
11	69	30.4	41	34	5	37	40	$1\frac{7}{16}$	$1\frac{15}{16}$	$1\frac{5}{16}$
yrs.	cm.	kg.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
				Norms.						
10 yrs.	69	29.7	36	35	28	90	85	3	$1\frac{13}{16}$	$1\frac{14}{16}$
5 mths.	cm.	kg.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.

Fig. 15, occlusal view. (No. 394.)

Fig. 16, front view.

The next cases are some in which special muscle groups were over or under-developed and the dental conditions associated with them.

Powerful jaw muscles sometimes accompany narrow arches. Such a case as—

Fig. 17, occlusal view. (No. 503.)

Fig. 18, side view of lower.

Fig. 19, side view of occlusion.

Fig. 20, front view.

MUSCLE TESTS. GIRL.

No. 503.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.L.
16	83	63.4	82	73	87	178	172	$4\frac{2}{16}$	$2\frac{6}{16}$	$2\frac{5}{16}$
yrs.	cm.	kg.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
	+	+	+	+	+	+	+			

FIG. 16.

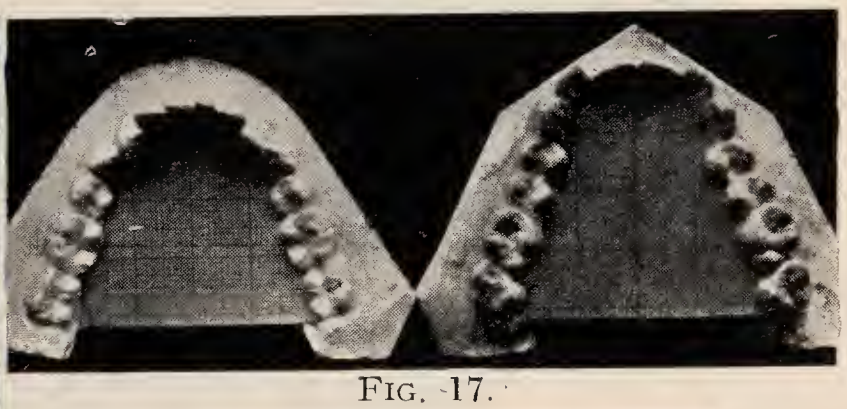


FIG. 17.

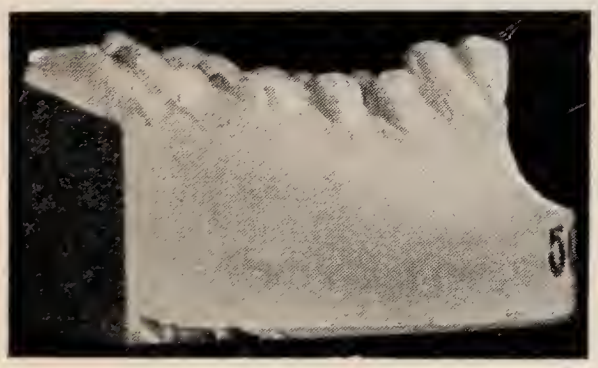


FIG. 18.

FIG. 19.

This case brings home to one the truth that muscle is only one factor in the development of the jaws and that there are many others of which little or nothing is known. One of the results of a powerful masseter muscle is to evert the angle of the lower

jaw,[3] but I do not think that its action or that of the temporal muscle is the dominating factor in determining the width of the dental arch (Fig. 21).

Fig. 22, occlusal view. (No. 5.)

The width of the lower arch between the lingual surfaces of the mesio-lingual cusps of the first molars is equal to 32.5 mm.

Muscle Tests. E. Home Girl.
No. 5.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.L.
$12\frac{7}{12}$	74	39.4	47	49	64	180	202	$3\frac{12}{16}$	$2\frac{3}{16}$	$2\frac{1}{16}$
yrs.	cm.	kg.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
				Norms for Boys of same Sitting Height.						
$12\frac{7}{12}$	74	38.3	49	47	38	115	122	$3\frac{12}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$
yrs.	cm.	kg.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.

Fig. 20.

Fig. 21.

Fig. 22.

I could find no relation between the incisor pressure and the degree of vertical overlapping of the incisors. Of the ten boys whose incisor pressure was over 60 lbs., two had almost no vertical overbite, the pressures being 77 lbs. and 70 lbs. The remaining eight cases had a vertical overbite varying from one-third of the labial surface of the lower incisors to completely covering the lower incisors. The highest pressure, 78 lbs., belonged to a case where the upper incisors completely covered the lower incisors. Of the three girls whose bite was over 60 lbs., all had a considerable overbite.

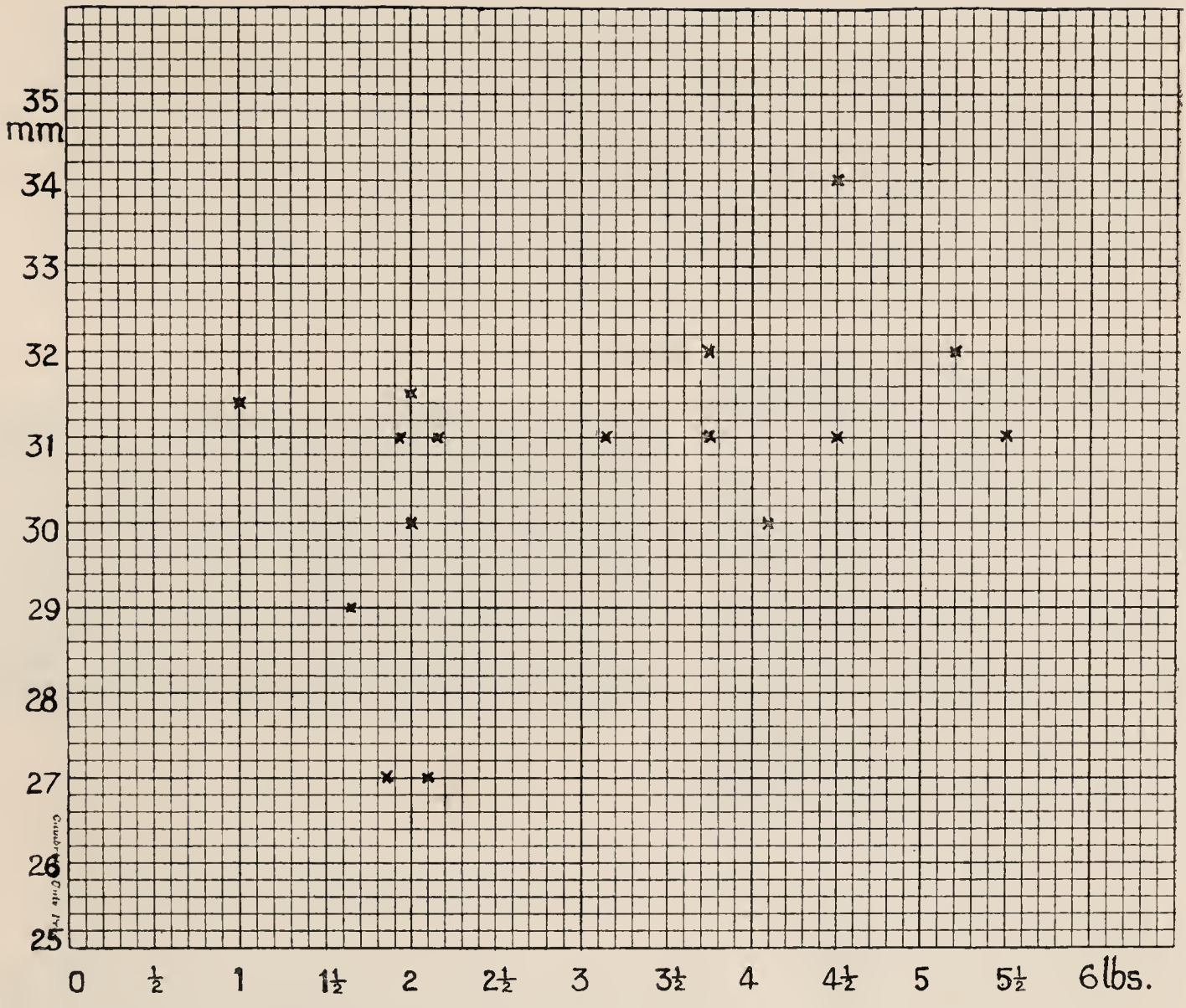


FIG. 23.—Width of lower arches in mm. of boys 69 cm. sitting height in relation to strength of tongue in lbs.

The incisor pressures of the boys where an edge-to-edge incisor occlusion was present were 30, 77, 70 and 15 lbs.

The incisor pressure of the girls where an edge-to-edge incisor occlusion was present were 35, 38, 33 and 57 lbs.

Vertical overbite of incisors. Incisor pressure over 60 lbs. :—

G. C. SCHOOL BOYS.

No. 24. Occlusion normal. Overbite one-third of lower incisors. Pressure 64 lbs.

No. 11. Occlusion Class II (Angle). Overbite completely covers labial surface of lower incisors. Pressure 78 lbs.

No. 19. Occlusion Class I (Angle). Overbite very slight. Pressure 77 lbs.

No. 20. Occlusion normal. Overbite half of lower incisors. Pressure 64 lbs.

No. 28. Occlusion normal. No overbite, slight open bite or edge-to-edge bite. Pressure 70 lbs.

No. 39. Occlusion Class I (Angle). Overbite one-third of lower incisors. Pressure 65 lbs.

No. 46. Occlusion normal. Overbite half of lower incisors. Pressure 74 lbs.

No. 47. Occlusion normal. Overbite two-thirds of lower incisors. Pressure 66 lbs.

No. 17. Occlusion normal. Overbite half of lower incisors. Pressure 65 lbs.

No. 12. Occlusion normal. Overbite one-third of lower incisors. Pressure 74 lbs.

E. Home Girls.

No. 2. Occlusion normal. Overbite 3.5 mm. Length of labial surface of lower incisors 8.1 mm. Pressure 70 lbs.

No. 9. Occlusion Class II (Angle). Overbite 4 mm. Length of labial surface of lower incisors 8.6 mm. Pressure 60 lbs.

No. 5. Occlusion normal. Overbite 1.7 mm. Length of labial surface of lower incisors 7.4 mm. Pressure 64 lbs.

No Overbite or very slight. G. C. School Boys.

No. 21.	Incisor	pressure	30 lbs.
No. 19.	,,	,,	77 ,,
No. 28.	,,	,,	70 ,,
No. 35.	,,	,,	15 ,,

No Overbite or very slight. E. Home Girls.

No. 18.	Incisor	pressure	35 lbs.
No. 15.	,,	,,	38 ,,
No. 13.	,,	,,	33 ,,
No. 6.	,,	,,	57 ,,

It has been pointed out by Knowles[9] that in Eskimos the glenoid fossa is very shallow in order to allow the lower jaw free lateral movement during mastication of very tough uncooked food. Ritchie[13] considers that this free lateral movement is dependent on the flatness of the curve of Spee and the edge-to-edge occlusion of the incisors and canines. It is possible that the muscles that control this lateral movement are under-developed in modern European man, and in some manner allow this overlapping bite of the incisors to appear.

The lip pressure is frequently weak in certain types of mouth-breathers, but it is not universally so. In some cases the horizontal pressure is weak and in others the vertical pressure, and in many others both pressures. The inability to keep the lips shut in some cases seemed to be due to short lips rather than weak lips. It certainly does not seem desirable to over-strengthen the lips by exercises unless one can at the same time restore the perverted function to the normal.

I referred to the influence of the tongue on the size of the arches at the beginning of my paper, and gave you extracts from Cryer and Sim Wallace whose points of view do not seem to be compatible. The size of the tongue is not always commensurate with its strength. A few cases have been seen where the tongue is large and flabby, with a weak dynamometric pressure. This is sometimes associated with thyroid deficiency; but I feel sure that the size of the tongue, whether it be due to a fibrous hyperplasia or to muscular strength, is one of the dominating factors in determining the width of the dental arches, especially the lower arch.

To demonstrate the influence which the strength of the tongue exercises on the width of the arches, extreme cases must be taken showing on the one hand that over-development causes spacing of the teeth and on the other that under-development causes narrowing of the arches and crowding of the teeth.

Fig. 23 shows the relation of the width of the arches to the strength of the tongues of children of a given height. At first glance this graph is very disappointing, as some of the widest arches are associated with the weakest tongues; but it should be remembered that not all large tongues are strong tongues, and also that every child will not exert his maximum strength on the

dynamometers. The graph does show that no case in this series with a strong tongue has a narrow arch.

Fig. 24 illustrates the occlusal view of a boy with a very strong tongue, 6 lbs. pressure. (No. 7.) Fig. 25 shows the front view in occlusion. Note the spacing of all the teeth and the molars not coming forward into the spaces. This boy was a normal nose-breather. The width of the lower arch between the lingual surfaces of the mesio-lingual cusps of the first molars is 35 mm.

Fig. 24.

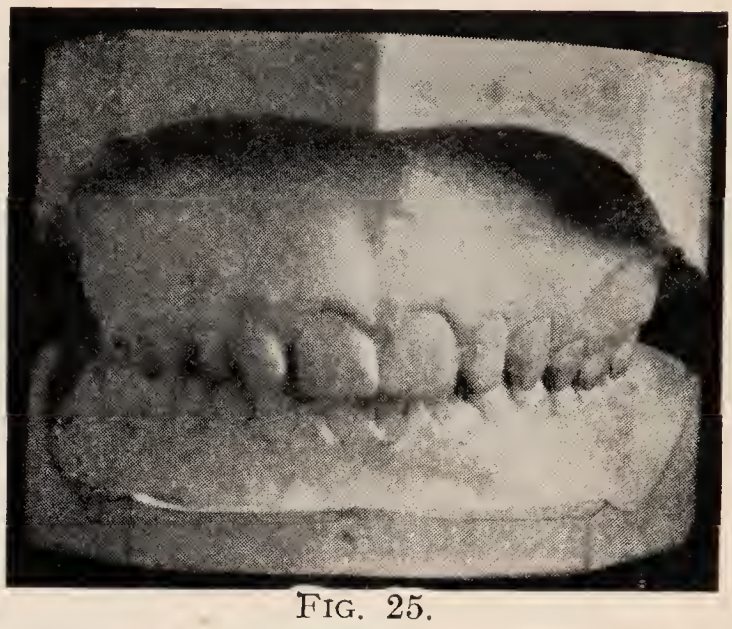


Fig. 25.

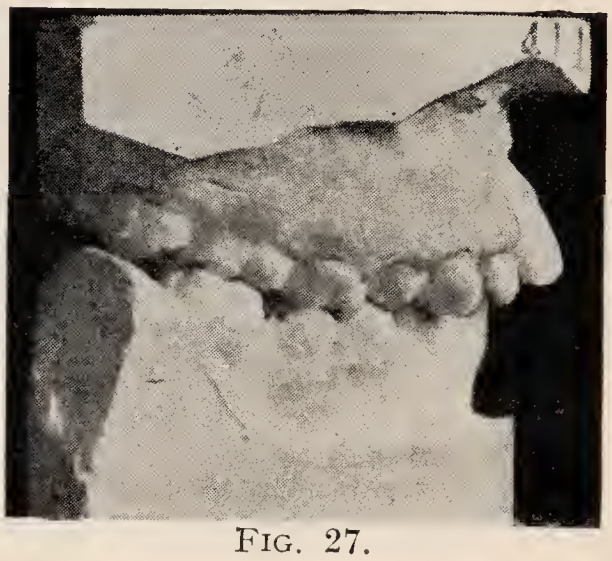


Fig. 27.

Fig. 26.

Muscle Tests. G.C. School.

No. 7.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P	L.M.P.	T.	V.L.	H.L.
14 yrs.	74 cm.	37.2 kg.	56 lbs.	56 lbs.	41 lbs.	135 lbs.	141 lbs.	6 lbs.	$2\frac{1}{16}$ lbs.	$1\frac{15}{16}$ lbs.
Norms for Boys 74 cm. Sitting Height.										
$12\frac{7}{12}$ yrs.	74 cm.	38.3 kg.	49 lbs.	47 lbs.	38 lbs.	115 lbs.	122 lbs.	$3\frac{12}{16}$ lbs.	$2\frac{4}{16}$ lbs.	$2\frac{5}{16}$ lbs.

The next case is perhaps the most interesting of all these, as it shows the action of the tongue on the development of the lower arch—the want of action of the lips, and finally the restoration of the function of the lips as the malocclusion was cured; this case was originally a mouth-breather. The narrowness of the upper arch compared with the lower arch can be accounted for by the fact that the tongue lies in the floor of the mouth during mouth-breathing.

No. 411*a*. Fig. 26, occlusal view.
,, 27, side view.
,, 28, front view.

No. 411*b*. Fig. 29, occlusal view.
,, 30, front view.

The width of lower arch, No. 411a, between the lingual surface of the mesio-lingual cusps of the first molars is 36 mm.

Muscle Tests of 411.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.L.	
12 yrs. 9 mths.	78 cm.	42.6 kg.	67 lbs.	60 lbs.	—	—	—	—	$12\frac{1}{2}$ oz.	—	Jan. 1922
—	—	—	60 lbs.	56 lbs.	40 lbs.	87 lbs.	83 lbs.	$6\frac{7}{16}$ lbs.	$1\frac{13}{16}$ lbs.	—	Oct. 1922
—	—	—	61 lbs.	56 lbs.	34 lbs.	93 lbs.	94 lbs.	$6\frac{3}{16}$ lbs.	$2\frac{7}{16}$ lbs.	$2\frac{4}{16}$ lbs.	Apr. 1923
—	84.5 cm.	56.2 kg.	67 lbs.	62 lbs.	56 lbs.	90 lbs.	93 lbs.	$6\frac{7}{16}$ lbs.	$2\frac{6}{16}$ lbs.	$2\frac{8}{16}$ lbs.	Aug. 1923
—	—	55.2 kg.	69 lbs.	62 lbs.	58 lbs.	100 lbs.	110 lbs.	$6\frac{12}{16}$ lbs.	$2\frac{3}{16}$ lbs.	$1\frac{14}{16}$ lbs.	Nov. 1923
—	84.7 cm.	57 kg.	69 lbs.	56 lbs.	42 lbs.	91 lbs.	101 lbs.	$6\frac{8}{16}$ lbs.	$2\frac{5}{16}$ lbs.	2 lbs.	Jan. 1924

The next case is an illustration of a weak tongue associated with narrow arches. The tongue pressure is only 6 oz. Jaw pressure and lip pressure were good (Fig. 31). (No. 481.)

The width between the lingual surface of the mesio-lingual cusp of the first molars is 25 mm.

Muscle Tests. Boy.
No. 481.

Age	S.Ht.	Wt.	R.Hg.	L.Hg.	I.P.	R.M.P.	L.M.P.	T.	V.L.	H.L.
$8\frac{6}{12}$ yrs.	67 cm.	24.4 kg.	36 lbs.	31 lbs.	14 lbs.	77 lbs.	70 lbs.	6 oz.	$1\frac{10}{16}$ lbs.	$2\frac{4}{16}$ lbs.
Norms for 67 cm. Sitting Height.										
$9\frac{11}{12}$ yrs.	—	28.3 kg.	29 lbs.	27 lbs.	32 lbs.	86 lbs.	79 lbs.	$2\frac{14}{16}$ lbs.	$1\frac{14}{16}$ lbs.	2 lbs.

Most of the boys in the orphanage were examined in October, 1922, and again in October, November, 1923. The relation of the tongue pressure to the width of the lower arch after the interval of one year was in some cases most suggestive. I give the details of the width of the lower arch and corresponding tongue pressure of seven cases in 1922 and again in 1923.

No.	*Width of lower arch between first molars.*	*Tongue pressure.*	*Date.*
31*a*	30 mm.	$1\frac{11}{16}$ lbs.	Oct., 1922
31*b*	31 mm.	$3\frac{12}{16}$ lbs.	Oct., 1923
	+ 1 mm.	+ $2\frac{1}{16}$ lbs.	
14*a*	27.7 mm.	$2\frac{2}{16}$ lbs.	Oct., 1922
14*b*	28.8 mm.	$3\frac{9}{16}$ lbs.	Oct., 1923
	+ 1.1 mm.	+ $1\frac{7}{16}$ lbs.	
3*a*	31.7 mm.	2 lbs.	Oct., 1922
3*b*	32.7 mm.	$3\frac{6}{16}$ lbs.	Oct., 1923
	+ 1 mm.	+ $1\frac{6}{16}$ lbs.	
8*a*	30.5 mm.	$1\frac{14}{16}$ lbs.	Oct., 1922
8*b*	32.4 mm.	$3\frac{1}{16}$ lbs.	Oct., 1923
	+ 1.9 mm.	+ $1\frac{3}{16}$ lbs.	
39*a*	32.5 mm.	$5\frac{3}{16}$ lbs.	Oct., 1922
39*b*	31.4 mm.	$3\frac{8}{16}$ lbs.	Oct., 1923
	− 1.1 mm.	− $1\frac{11}{16}$ lbs.	
6*a*	31.8 mm.	$3\frac{5}{16}$ lbs.	Oct., 1922
6*b*	31.3 mm.	$1\frac{11}{16}$ lbs.	Oct., 1923
	− .5 mm.	− $1\frac{10}{16}$ lbs.	
9*a*	33 mm.	$5\frac{7}{16}$ lbs.	Oct., 1922
9*b*	33 mm.	$3\frac{9}{16}$ lbs.	Oct., 1923
		− $1\frac{14}{16}$ lbs.	

It seems probable that the development of the arches and the arrangement of the teeth is dependent to a great extent on the proper development and balance of the different muscle groups and that in order to arrive at a correct diagnosis of the individual musculature we shall have to test not only the groups of muscles, as I have done, but also the opposing groups of muscles. I am about to have two further instruments made, one to test the strength of the buccinator and the other to test the depressors of the mandible. Fig. 32 is a drawing of the proposed instrument for testing the buccinator.

FIG. 28.

FIG. 29.

FIG. 30.

FIG. 31.

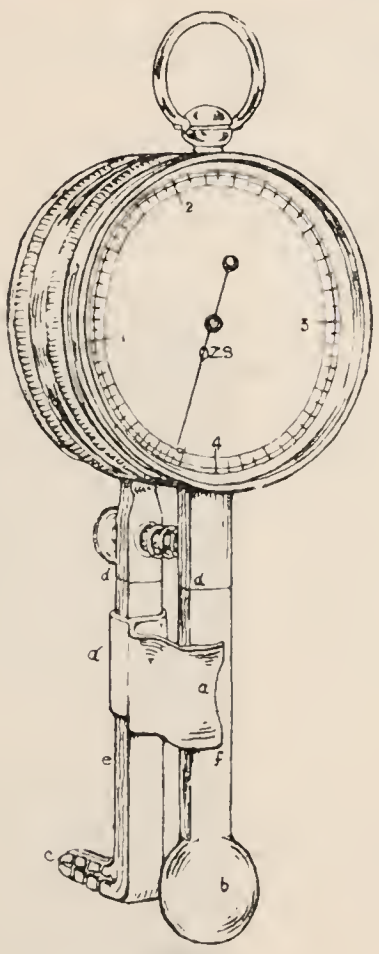


FIG. 32.—Dynamometer for testing buccinators. Milled portion C held firmly between first molars. Lip guard AA′ slides along bar E. Guard prevents action of corner of lips on bar F. The buccinator exerts pressure on portion B.

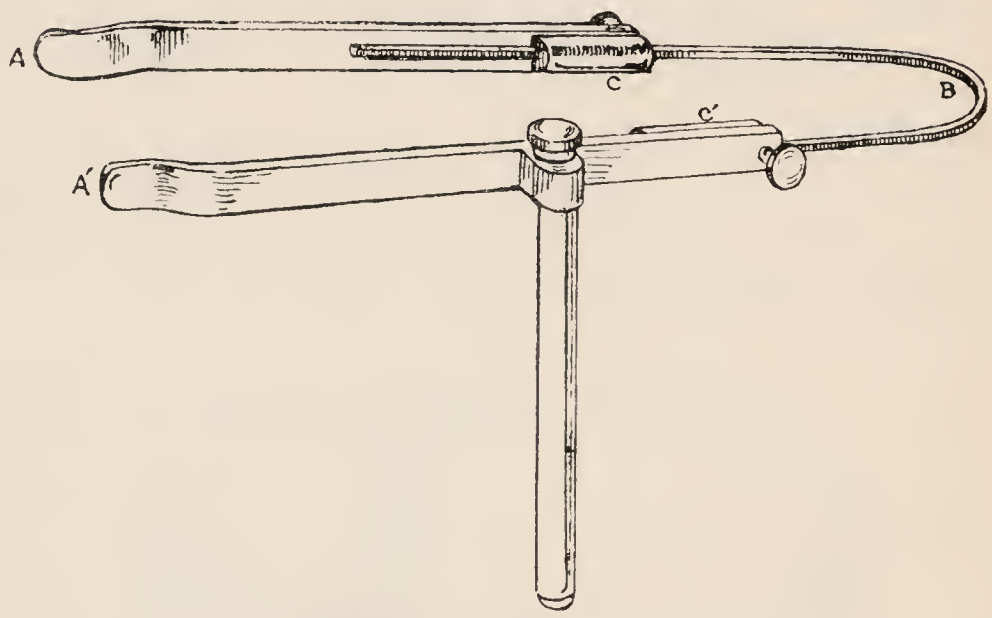


FIG. 33.—Lip exerciser. U spring B can be moved through sockets C and C′ in order to increase the force necessary to close lip portions A and A′ from 3 oz. to 18 oz.

Much has been written in the American dental journals on muscle training as a means of curing malocclusion or at least as an adjunct in treatment. Many ingenious exercises have been suggested, especially by A. P. Rogers.[10] That such training must form an integral part of successful treatment I have not the least doubt.

From the illustrations I have given, the association between under and over-developed muscles and certain forms of malocclusion is, I think, clear. A great advance would have been made in orthodontics if it were possible so to develop the affected muscles that they could carry out their normal function with ease. It would, however, also be important to make sure that they were then free from extraneous hindrances to their normal functioning, e.g. it is of little use making it possible for the lips to be kept naturally shut, unless at the same time we see that the nose is in such a state that it permits free passage of air.

I would make the following suggestions to those who take up this branch of orthodontics :—

(1) Determine which groups of muscles are affected and confine attention to these.

(2) It is essential to ensure the co-operation of the patient. The child should clearly understand the purpose of the exercise and at the time concentrate his whole mind on the group of muscles selected for development.

(3) Avoid exercises which may produce unnatural habit movements and choose those which simulate the natural function of the groups of muscles under consideration.

(4) Beware of overfatiguing the muscles, overloading them, or reducing them to a state of staleness.

The repetitions of each exercise in two daily periods should be graduated from small beginnings and discontinued at the first signs of fatigue.

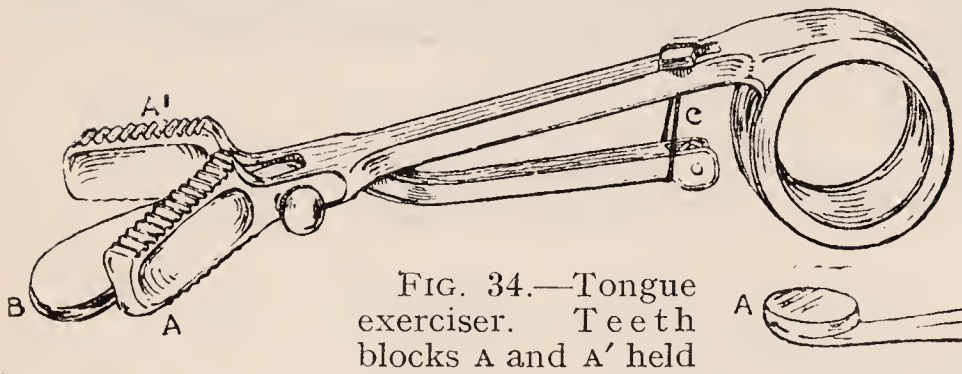


FIG. 34.—Tongue exerciser. Teeth blocks A and A′ held firmly between teeth. Tongue presses B upwards and forwards. Resistance to action of tongue obtained by elastic ring at C.

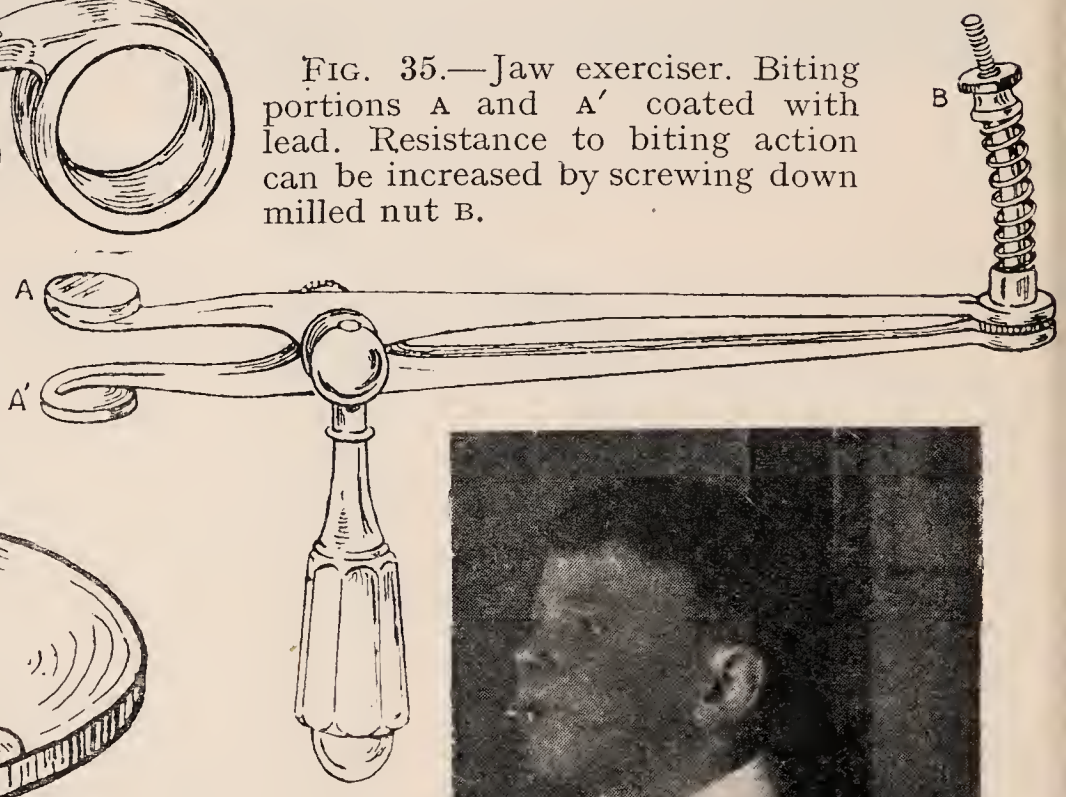


FIG. 35.—Jaw exerciser. Biting portions A and A′ coated with lead. Resistance to biting action can be increased by screwing down milled nut B.

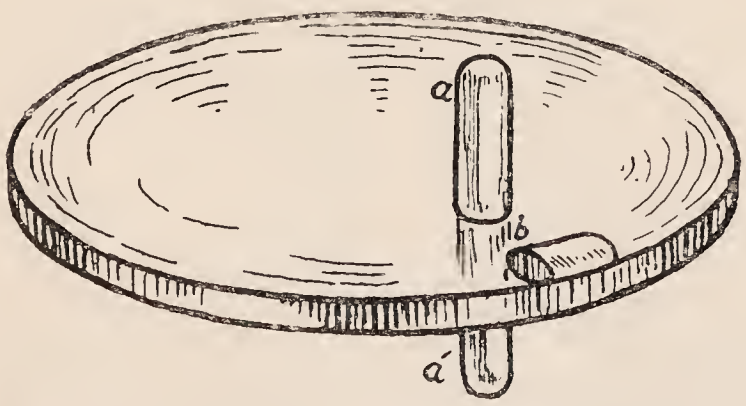


FIG. 36.—Lip disc. Rod AA′ prevents disc being held between teeth.

Fig. 37.

Personally, I think it more possible to distinguish between maldevelopment of special groups of muscles and general maldevelopment by means of these dynamometers than by any other known method. It is open to question whether better results can be obtained by voluntary contractions of the particular muscle group, or by the use of mechanical exercisers. The danger of introducing habit movements with voluntary contractions, which if once established might produce an even worse malocclusion, is avoided with exercisers.

During the last few months I have been experimentally using the following exercisers :—

Lip exerciser by Rogers[10] Tongue Exerciser by — Fig. 34.
„ „ „ Friel, Fig. 33 Jaw „ „ — „ 35.

As you know, it is very easy to overstrain a muscle and very difficult to heal the resultant damage. Therefore I think dynamometers essential if exercises are to be used in order that the strength of the exerciser may be set proportionate to the strength of the muscle. If the instrument is set at a quarter of the maximum strength of the muscle, it will do no harm.

I have observed during treatment by orthodontic appliances an appreciable tendency of the jaw pressure to diminish, but I find the pressure can be maintained by means of biting exercises. Many children have such small capacity for pressure with their incisors that they cannot bite a raw apple without pain. The jaw pressure between the incisors can be increased in suitable cases by biting exercises, adding much to the comfort of the patient. Incisor pressure has been increased from 6 lbs. to 34 lbs. in a few months.

Probably all cases under treatment by appliances would benefit materially from an increased function. Oppenheim[11 12] showed in his experiments of moving the teeth of monkeys that the striæ of the bone were formed more or less parallel to the direction of the greatest force. For example, in moving an incisor forwards, the bone in front of the tooth was absorbed on the side adjacent to and built up on the side remote from the tooth. The striæ of this new bone were parallel to the direction of the force. In a later experiment he showed that during retention this newly formed bone was reformed and that its striæ again became parallel to the long axis of the tooth, i.e. in order to withstand the greatest force, the force of mastication. This fulfils Wollf's law of bone transformation. Possibly there might be a considerable reduction in retention if the function of mastication was greatly increased, as by biting exercises.

Exercising the tongue undoubtedly leads to an increased dynamometric reading, but whether this increase of pressure portends a corresponding increase in the size of the tongue I am not yet in a position to state. I have five cases at present with narrow and crowded arches all coming under Class I (Angle) who are being treated only by exercises. I hope that at the end of a year I shall see some marked improvement in the size of their arches.

The hanging lower lip and short upper lip of a mouth-breather have always been a perplexing problem for the orthodontist, and I think we are greatly indebted to Rogers for his suggested exercises for the treatment of this condition. By the use of an exerciser it is possible to increase the dynamometric reading of the lips, but this alone in most cases is not sufficient to cure the mouth-breathing. I have recently experimented with a very

simple appliance in order to get rid of the habit of keeping the lips apart (Figs. 36 and 37). A small metal disc about the size and thickness of a penny (3.2 cm. by .2 cm.) is held between the lips for periods during the day, the length of a period being increased as the lips get more adapted to their new position.

In conclusion, I would bring to your notice one other exercise suggested by Rogers,[10] which seems to me uncommonly good. He calls it a tonic exercise. This is his description of it: "It is frequently found necessary to prescribe a tonic exercise, which I have termed the exercise for general facial development. This exercise influences not only the orbicularis oris, but also the buccinator and all the small ribbon muscles which enter into a combination with the orbicularis oris. It consists in the use of warm water at a temperature which is bearable to the mucous membrane of the mouth, and in which has been dissolved a small portion of bicarbonate of soda; the patient is directed to take a sip of the solution, closing the teeth firmly in position and with great energy forcing the liquid from the lingual cavity into the buccal." When properly carried out this exercise must benefit the muscles of the tongue, the buccinators and muscles of the lips.

My own aim in muscle training has been directed altogether to building up the individual groups of under-developed facial muscles. (Those cases where the entire musculature of the body is undeveloped are more suited to treatment by a physician than by an orthodontist.)

From what I have told you to-night you will have realised that my own theories and methods are as yet in the experimental stage; but nevertheless, as I said earlier, I feel convinced that muscle training must eventually form an integral part of treatment in many types of malocclusion.

It should not, however, be forgotten that muscle training cannot be judiciously undertaken without previous muscle testing. Definite methods of correlating the strengths of different muscles with each other and with the general development of the child must be employed if good and not harm is to follow. I have suggested the use of dynamometers, but some alternative may be raised from the melting-pot of longer and wider experiences.

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Discussion.

Dr. Sim Wallace said he felt a personal satisfaction in the extremely scientific way in which the President had corroborated an attempt of his own made twenty years ago. The paper, he thought, would have some far-reaching consequences. The President had spoken about a book which he (Dr. Sim Wallace) had written twenty-four years ago. That was a slight mistake. That book had been published in January, 1904, so that it was only twenty years old; it had not come of age. Next year it would celebrate its twenty-first birthday, and he now believed by that time it would be perfectly up-to-date. There was one thing about the paper which he did not quite like. The President had referred to Cryer's ideas and his (Dr. Sim Wallace's) own and had shown that they were quite incompatible. He quite agreed with that, but he would have liked it better if the President had shown the very considerable amount of agreement which existed between himself and the President. The President said that in orthodontics it was of the greatest importance to determine, even in a rough and ready manner, whether the child under examination was physically fit, and asked the question, "Can we expect to have well-developed arches in a child that is physically unfit?" He had answered that question (on page 79 of his book) very much as the President had done, in the negative. Again, the President said that one of the results of a powerful masseter was to evert the angle of the lower jaw. Personally he had come to a similar conclusion. He forgot whether it was from looking at skulls or otherwise, but anyhow he had referred to the fact that in those races which used their masseters most the angle of the lower jaw was everted (pages 40 and 41). The President further said, "I do not think that its action or that of the temporal muscle is the dominating factor in determining the width of the dental arch." Neither did he himself. Mr. Friel also referred to the size of the tongue not always being commensurate with its strength, and referred to cases of thyroid deficiency. On that point also he and the President were in very thorough agreement. He understood that thyroid deficiency was characteristic of cretinism. Cretins were weak and small, but the tongue was pathologically large, and the arches of the teeth were well developed notwithstanding their weak physical development (p. 101). That was a significant though exceptional case. However, he and the President appeared to be in complete agreement as to that point. Perhaps some of the members had noticed in the December number of the *Dental Magazine* a paper by Prof. Izard in which he explained Dr. A. P. Rogers's exercises and referred to them as a new physiological method. He (Dr. Sim Wallace) was inclined to think they were by no means new, because he himself had advocated general and special physiological muscular exercises twenty years ago (page 115). These exercises were not the artificial exercises which had been recommended by Dr. Rogers but rather the exercises which had been prescribed by Nature for the last few million years. More recently he had indicated that some exercises ought to commence with the eruption of the incisors, i.e. with gnawing exercises to prevent post-normal occlusion.

The President had disposed of Prof. Pickerill's and Dr. Cryer's theories but he had not referred to the fate of Sir Arthur Keith's theory. If he understood Sir Arthur Keith correctly his view was that there had been some gradual change in the hormones, especially from the pituitary, and that he assumed there was some hereditary difference between us and our Anglo-Saxon or Neolithic ancestors; but if it were true that we lacked such muscular exercises as were associated with the mastication of coarse and fibrous foods, we had no need whatever for introducing a hypothetical lack of the developmental stimulus associated with hormones. Mr. Watkins had recently brought forward a case, and he himself had referred to some cases

in his book, showing how the tongue influenced the development of jaws and teeth. Prof. Izard also mentioned cases showing how the tongue in macroglossia increased the dental arch and that, after the tongue was reduced by operative treatment, the jaws and teeth reverted to normal. Altogether he thought it was the similarity of his and the President's views which should have been emphasised rather than the difference between his and Dr. Cryer's views. There was, of course, a great difference between anything which he had done and the work of Mr. Sheldon Friel. Mr. Friel had gone into the matter in a very thorough and scientific way, whereas what he himself had done had been perhaps rather in the nature of ratiocination. Fortunately, however, his reasoning seemed to have been right, and if he did speak dogmatically twenty years ago he had the satisfaction of learning now that he had been justified in doing so. He concluded by congratulating the President on his very excellent paper.

Mr. Robert Lindsay said his reason for rising to speak was that he was one of the very few who had seen the beautiful instruments shown by the President actually at work. He recalled a very delightful morning which he had spent in Dublin seeing some of the children, whose photographs had been put upon the screen, being put through the particular tests described. He did not intend to touch upon the anatomical incongruities which the President had instanced in his paper, although he might remind Dr. Sim Wallace that probably the President was right in dating Dr. Wallace's contribution as being twenty-four years old, because the first chapter of the book had been published in the *British Dental Journal* twenty-four years ago. There was one statement of Sir Arthur Keith's which perhaps the President might be induced to remark upon in any reply he made. Sir Arthur Keith suggested that the modern inhabitants of our Western cities had practically lost the power of biting. It would appear from the President's demonstration that evening that the power of biting with the incisor teeth was rather strongly maintained in modern children. Therefore it was not necessary to suppose that when that power existed to such a degree as had been demonstrated on the screen that the inhabitants of Western cities had lost the biting function with their incisor teeth. He thought the members might congratulate the President upon following up what had been done by Sir Arthur Keith and Mr. Campion at a much earlier period in the present Session, when they had demonstrated the developmental possibilities in connection with orthodontics. In doing so he thought the President had given the pendulum an impetus away from what had been rather an unfortunate tendency—if he might say so—in modern orthodontics. They had always regretted greatly that in ordinary dental practice so much attention was paid to prosthetics, and the perfection of implements and of processes seemed to determine very largely the direction of modern dental surgery. In the same way it seemed to him that the perfection of the apparatus which had been used in orthodontics had rather inclined orthodontists towards the excessive use of apparatus, and it would be a very good thing indeed for everybody concerned if there was less attention paid to orthodontic ironmongery and a little more to the line which the President had indicated —the natural way in which irregularities of the teeth might be prevented, and might even be, to a large extent, cured. With reference to the President's remark that all muscular exercises—orthodontic exercises—should be preceded by muscle testing, he thought that was a correct scientific attitude to take up, but when one reflected upon the intricacy and delicacy of the instruments, and their cost, he feared it was not at all likely that they could become part of the ordinary equipment of the ordinary orthodontist. He would suggest that a very large amount of muscle exercise might be quite sufficiently

and effectively done without the necessity for muscle testing. So far as he could gather—and he had attended very carefully to the address—the President did not definitely associate any particular irregularities with either deficiencies or over-development of a particular group of muscles, but simply indicated the advantage to the orthodontist of being able to test the strength of the muscle before he attempted to blame it for some particular deficiency. With regard to the question of the tongue, it had always seemed to him that the dynamic force of the tongue was sometimes overlooked. For example, a small but active tongue might do very much more in influencing the arches than a large and flabby one. When one reflected that in modern days the tongue had a very large activity in the ordinary actions of speech, that might be held to make up, to a certain extent, for a smaller amount of activity in the mastication of coarse food. The development of the tongue had also to be remembered. It had occurred to him while Dr. Sim Wallace had been speaking that the thyroid gland and the tongue practically had a developmental origin similar to each other, and it was just possible that if a thyroid gland was imperfectly developed, the tongue itself would also be imperfectly developed. There were very far-reaching points in connection with that matter to be considered. It seemed to him that the President, in describing his operations in muscle testing, had gone a step further than Rogers, because Rogers had not that very ingenious set of dynamometers for recording tests which the President had. Rogers had only one dynamometer. Was it not the case also that Johnson and Hatfield had been confined to two dynamometers with which they could make the tests? Sir Arthur Keith spoke of the forcing of the condyles of the jaw into the glenoid cavity when pressure was brought to bear upon the molars. Johnson, on the other hand, said that the pressure and the pain were felt in the periosteal membrane, and that it was not the power of the muscle to contract which was the check upon the ultimate register, but the pain which was induced in the tissues surrounding the teeth. That would seem to indicate that there was not that pressure in the glenoid cavity on mastication which would be indicated by what Sir Arthur Keith had said. Johnson had, however, also said that in certain cases he had pain referred to the temporo-mandibular articulation instead of to the sockets of the teeth, and he would like to ask the President if he had anything to recall in that respect—as to whether the actual pain felt was in the sockets or in the articulation in the exercises and tests through which he had put the patients. He concluded by expressing the great pleasure it had given him in having listened to the President's address.

Mr. B. Bull said he only desired to raise one point, and that was in connection with the mention made of the inhabitants of the Western Isles and the relationship between the incisor pressure and the degree of vertical overlapping of the incisors. The President said he could find no relation between them. That seemed to be a most extraordinary thing, because if one went back to the prehistoric men, they had an edge-to-edge bite, and considering their method of feeding, he would have thought that their incisor pressure would have been simply enormous compared with the modern man with the vertical overlapping of the incisor teeth.

Mr. Pitts said he would like to add his humble meed of admiration on the President's very masterly address, which had placed every orthodontist under a deep debt of gratitude—how deep he did not think they at present realised. He had used in one case the Roger's Exerciser for the orbicularis oris muscle, which, according to the testimony of the parents and others, had yielded a good result. The patient was a girl with a post-normal occlusion, a mouth-breather, and with that thick heavy lower lip which was so often seen. It seemed to him that if one could get greater muscularity in that lip

it would be an advantage. He had put the patient on that treatment; she was very interested in it and carried it out very well, and there was no doubt that it had made the lip very much more mobile. He had, of course, used it empirically, without any preliminary testing, and without having the vaguest idea of what the normal pressure on the lip ought to be and how far it was deficient. He believed that the tonic mouthwash which Rogers spoke of would probably be just as effective, but it was to be said that the instrument of Rogers was a rather showy little device which piqued the curiosity of the patients and therefore you thought they were more likely to use it than such a very humble and humdrum thing as a mouthwash. There was a good deal of evidence that use did play a very important part in the power of the lip. For instance, if one looked at the photographs of actors one could not but be struck by the very finely chiselled and mobile lips which they possessed. Probably constant public speaking, and the necessity for clear enunciation, had a very big effect on strengthening the power of the lips, which suggested that the exercise might have a use outside of orthodontics.

Mr. HAROLD CHAPMAN said the members had listened that evening to a most admirable paper, the value of which, as Mr. Pitts had said, they did not yet fully realise. The President, in the first paragraph of his paper, said that his heart failed him, but there was no need for him to have said that, because he had shown himself that evening a very worthy successor of his illustrious predecessors in the chair. The paper was most valuable on account of its lack of complexity. He would like to have said on account of its simplicity, but he was afraid that if he did so one would infer that it was a simple paper, and he did not want that impression to go forth. It was, to his mind, a highly scientific and practical paper, written in such a way that members had been able to enjoy it thoroughly. He really did not remember any paper which had been read before the Society which had been so constructive in its efforts. If in any way it had been destructive, it had only been destructive from a constructive point of view, if he might put it so. To give an example, he was afraid that his own efforts in muscle training had been absolutely empirical, and the President had been most destructive from that point of view. His (the speaker's) method had been to give children a rubber bone. They bit on that bone in five different places. Not only had they to bite simply, but they had also to bite with a pulling motion so that they got two different kinds of exercises in the same way. Unfortunately, however, he was not able to tell whether their muscle pressures increased or not. There was no doubt that if one was going to do it scientifically one must use dynamometers. That brought him to the point about the incisor pressure and the use of the masseter and pterygoids. In a paper elsewhere he had referred to the fact that possibly overbite was due to a lack of development of the posterior portion of the horizontal ramus of the mandible on account of insufficiency of muscle action, i.e. of the masseters and pterygoids, and if that were so it was a result of imperfect or insufficient use of the incisors (if it were true that the incisive function was operated by the masseter and pterygoids). So excessive overbite may be the result of lack of function of the incisors in the first three or four years of life. It would be interesting and instructive to have the muscle pressures at that early period to confirm or destroy this theory; the high incisor pressures of the permanent teeth would appear to upset it, but other factors may arise to produce them. Personally he thought that proper use of the incisors in the early years of life would tend to give a normal overbite, for the reason that those muscles would be exercised which were attached to that portion of the jaw where development was necessary to give a correct overbite. With regard to Class 2 cases, he would like to ask the

President if he had found any difference in the Division 1 cases and the Division 2 cases with regard to lip pressures; in one the lips were supposed to have no effect or give no assistance in keeping back the upper incisors, as in the child they had seen, and in the other case —that was Division 2, with the non-prominent incisors—whether those lips were stronger, as some believed.

A short time ago he had heard of a case—he could scarcely credit it was actually so—in which the upper incisors were driven back into a Division 2 type by means of the lips. Also in a recent paper Dr. Pont had said that the muscles in Class 2 cases were much weaker than they were in the others, but what methods Dr. Pont used for testing he did not know. He had used the President's lip exerciser in one case with most satisfactory results. The patient had been treated before he had seen him, and the only thing that was wrong was that he had had an excessive overbite. Otherwise the case was correct. It was so excessive that the upper incisors were bound to be pushed out again unless the molars came up elongated. That case had improved remarkably. He had only seen the boy about half a dozen times. The bite had opened well and his lip was keeping down well over his teeth. He had been under treatment for about a year—not sufficiently long perhaps to judge—but so far the result had been most pleasing, and it was confirmed by the parents. He would like to ask the President what method he used for testing the size of the tongue. It seemed to him to be a matter which was difficult to gauge. It would be interesting, too, to know the ages of the patients which he was treating with muscle exercises only. It seemed to him to offer very great possibilities. The help which he had been able to give the President had been really of no account, and did not deserve mention, but it must have occurred to everybody, although no one had mentioned it, that 105 of the cases were outside the President's own private practice, and the work which had been entailed in getting the models, examining the patients, making the graphs and so on must have been enormous, to say nothing of the fact of thinking out the instruments which were all the President's own design. The members that evening had heard about it all in the course of an hour or so, but he would not like to think of how many years the work had taken the President. He desired to offer him his very hearty and sincere congratulations on his efforts.

The PRESIDENT, replying, said that Mr. Lindsay had suggested that modern man could not be suffering from any deficiency of muscular strength as he had such very great power of incisor pressure, but as orthodontists did not know what power was possessed by pre-historic man, or Eskimos at the present time, that problem could not be solved until Mr. Lindsay went to the Arctic and pursued researches there. So far as he knew, Dr. Rogers had no dynamometers in use for muscle testing. Whenever he had asked patients where they felt pain when biting, they had always indicated the periodontal membrane; none of them had referred the pain to the condyles. Mr. Bull and several other speakers had spoken of a possible relation between incisor bite and the overlapping of the incisors, in regard to which he had quoted from Sir Arthur Keith. Personally he could find no relation, but until he had opportunity to examine larger numbers could not speak conclusively. There were more with overbite with high pressure than there were with edge-to-edge and high pressure. Mr. Chapman had asked whether the lip pressure was different in Class 2, Division 1 (Angle) from that in Class 2, Division 2 (Angle). It was greatest in those in the retruding upper incisors. Mr. Chapman had also asked how he tested the size of the tongue. He did not know how one could test the size of the tongue except by looking at it, and looking at it again. He had also been asked the age of those patients who were being treated with exercises only. The patients

were five boys of 8 to 10 years of age. He thanked the members very much for the very flattering things they had said about his address.

On the motion of Mr. W. Rushton, a hearty vote of thanks was accorded to the President for his address, which Mr. Rushton said was one of the most interesting and remarkable addresses which the Society had ever had, and was the outcome of careful scientific research.

An Ordinary Meeting was held on Monday, February 4th, 1924, Mr. Sheldon Friel (President) in the chair.

Regulations Concerning Prizes for Open Competition.

Mr. Northcroft moved, and Mr. Schelling seconded, that the meeting should become a meeting for the conduct of special business, and this was agreed to unanimously.

Mr. F. B. Bull then proposed, and Mr. Pitts seconded, that the Regulations concerning prizes for open competition, drawn up by the Council, should be approved.

Mr. Rt. Lindsay asked whether it was a fact that the conditions set out in the Regulations would make the prizes open to any person, irrespective of a dental or other qualification.

The President said that he thought they were open to any person.

Mr. Rt. Lindsay said that he hoped that was the case, but he wanted it made clear. His only doubt as to the rightfulness of this procedure was that possibly some literary celebrity outside the dental profession might read up the subject to such an extent as to become a competitor for the prizes.

Mr. Northcroft suggested that the Council should reconsider the number and amount of the prizes. Instead of having a second, third and fourth prize each of ten guineas, he would favour a second prize of twenty guineas, a third prize of ten guineas, and the elimination of the fourth prize. The Society would not be called upon to spend any more money, and it would secure a certain difference in value between the subsidiary prizes.

Mr. Chapman said that he would be very happy to second Mr. Northcroft's proposal. In fact, he wished that Mr. Northcroft had increased his suggestion as to the amount of the second prize from twenty guineas to thirty guineas. He thought he was not committing any breach of confidence when he said that the Council had not felt justified in spending more money than was recommended in the draft regulations without the sanction of the members as a whole. The Council, according to the By-laws, had the sole management of the Society's affairs, so that it was an act of grace on their part to consult the members, but he thought that if the meeting would agree to spend rather more money on prizes, the Council would adopt any such recommendations. Prizes of perhaps thirty and twenty guineas respectively would offer a little more stimulus to competitors, although they still would not remunerate a man for the work he had done. The additional expense would not break the Society, because a sum of £150 had been lying idle in the Society's funds for ten years or more, and this might fittingly be drawn upon for the present purpose.

Mr. Northcroft said that he was perfectly willing to alter his amendment so that it would run that the second and third prizes be respectively thirty and twenty guineas and the fourth prize be eliminated.

Mr. Chapman then seconded this amendment.

Mr. Rt. Lindsay said that any hesitancy which the ordinary members would have in accepting such an amendment must be greatly diminished

by the fact that the members of the Council themselves seemed to come forward with a desire that more money should be expended. His only doubt was whether it was quite wise to bring these subsidiary prizes up to so near the value of the first prize. The subsidiary prizes were simply an acknowledgment of the trouble taken by the competitor, and not in any sense an adequate remuneration.

Mr. CHAPMAN thought that Mr. Lindsay might be consoled by the reflection that, while the first prize was open to all nationalities, the other prizes would be open to British subjects only.

Mr. PITTS said that it seemed to him that the Regulations making the first prize open to all nationalities, and restricting the other prizes to British subjects made a distinction which was a little invidious, and he would like the meeting to consider whether such a distinction was worth while.

The TREASURER said that during the last three years the expenses of the Society had considerably increased by reason of the cost of blocks for illustrating the papers. In 1922 this item increased the expenses by no less than £50, and the balance sheet that year showed a deficit of £19. He did not quite see how the Society was going permanently to provide prizes of such high value as were set out in the amendment.

Mr. RT. LINDSAY, in view of the Treasurer's statement, supported the Council's original recommendation.

Mr. WARWICK JAMES spoke in the same sense, pointing out the additional expense which Mr. Northcroft's proposal would entail; there would also be the cost of casting a silver medal and the making of some honorarium to the examiners.

The amendment by Mr. Northcroft, making the second and third prizes thirty and twenty guineas respectively was then put and lost.

Mr. WARWICK JAMES then proposed that the second prize be twenty guineas and the third prize ten guineas.

Mr. SCHELLING seconded, and this amendment was carried.

Mr. PITTS then again raised the question of Rule No. 4, which made the first prize open to all nationalities and restricted the other prizes to British subjects. He moved that any restriction of nationality be omitted from that Rule, so that it would read: "All the prizes are open to all nationalities."

Mr. RT. LINDSAY seconded. He looked upon the nationality restriction as the sole blemish upon the scheme.

Mr. WARWICK JAMES said that the object of this proposal was to induce work to be done in this country, and it was thought that an honorarium of the kind suggested might act as a stimulus.

The amendment was carried.

The PRESIDENT pointed out that these amendments could only be in the nature of recommendations to the Council.

Mr. LACEY thought that despite the amendment which had just been passed, an additional prize might be given to British subjects if finances allowed, but he would not move an amendment.

Mr. RT. LINDSAY suggested the setting up of a special prize for British orthodontists. It was unfortunate that in the original Regulations it was taken for granted that British orthodontists would be satisfied with a second prize. But the Council might encouarge British orthodontists by a special prize.

The SECRETARY read By-law 49, which required such suggestions to be sent in in writing to the Council, and Mr. LINDSAY said that he would take care that this was forwarded.

Dr. SIM WALLACE said that, so far as he could see, there was only one subject set down for competition. He thought this would tend to make the younger members limit their attention to this one subject, and he would prefer that a prize should be given for the best paper or contribution of the year or in three years, the subject being left open to the competitor's own choice. It was possible that by this method

an excellent paper might be forthcoming on some subject that no one else had ever thought of, and it would be a pity if such a contribution could not have an award in some way or the other. He would move an amendment to that effect, that while the first prize of fifty guineas should remain for the best essay on the subject set out in Rule 3, there should be a special prize for the best contribution to orthodontics by any member of the Society on any subject of his own selection.

A MEMBER pointed out that the prize offered by the Royal College of Surgeons for 1925 was on a very similar subject to the one set out by the Council.

Dr. WALLACE'S amendment found no seconder, and was not pressed, but he agreed, at a suggestion from the chair, to bring it forward on another occasion.

Mr. RT. LINDSAY then moved, and Mr. SAMUEL seconded, that the question be now put, and this being agreed to, the motion, "That the Report as amended be approved," was then agreed to unanimously.

NOTICE CONCERNING PRIZES FOR OPEN COMPETITION.

1. The Society offers the following prizes for competition; they will be awarded triennially by the Society. The first award will be for the three years ending December 31st, 1926.

2. The prizes are as follows:—

(1) A medal executed in silver and an honorarium of 50 guineas.
(2) An honorarium of 10 guineas.
(3) An honorarium of 10 guineas.
(4) An honorarium of 10 guineas.

or such sums as the Council may from time to time determine.

3. The subject for the essays to be submitted in competition for the prizes for the triennial period ending December 31st, 1926, is: "The Macroscopic Changes which Normally Occur in the Jaws and Teeth of Man and in their Mutual Relations, from Birth to the Complete Eruption of the Second Permanent Molars."

4. The first prize is open to all nationalities; the other prizes are restricted to British subjects.

A CASE OF PARTIAL NASAL OBSTRUCTION FROM 5–19 YEARS OF AGE.

By F. BOCQUET BULL, L.D.S., M.R.C.S., L.R.C.P.

THE patient, a male, was born in November, 1881. In 1886 or 1887, at the age of 5 or 6 years, he pushed up one of his nostrils a small piece of rubber such as is found in the end of a cheap pencil and pencil-holder.

About 1899 or 1900 the patient would then be about 18 or 19 years of age, a rhinolith was removed from the nose by Dr. Greville Macdonald at King's College Hospital. This rhinolith was too large to be removed without first crushing it. The piece of rubber undoubtedly formed the core or nucleus of the rhinolith, and had, therefore, been present for thirteen years during the adolescent stage.

For a few years previous to the removal, the patient had suffered from frontal headache, confined chiefly to the supraorbital region. He had also, at intervals, been in the habit of removing large casts of congealed mucus of the consistency of cheese, which were sometimes as large as the kernel of a Brazil nut. They were removed, with great difficulty, by a series of vigorous naso-oral inhalations, into the pharynx, and then coughed out.

CASE OF PARTIAL NASAL OBSTRUCTION.

By F. Bocquet Bull, L.D.S., M.R.C.S., L.R.C.P.

Fig. 1. Palatal view of upper jaw.

Fig. 2. Lower jaw showing overcrowding in incisor region.

Fig. 3. Buccal view, left side.

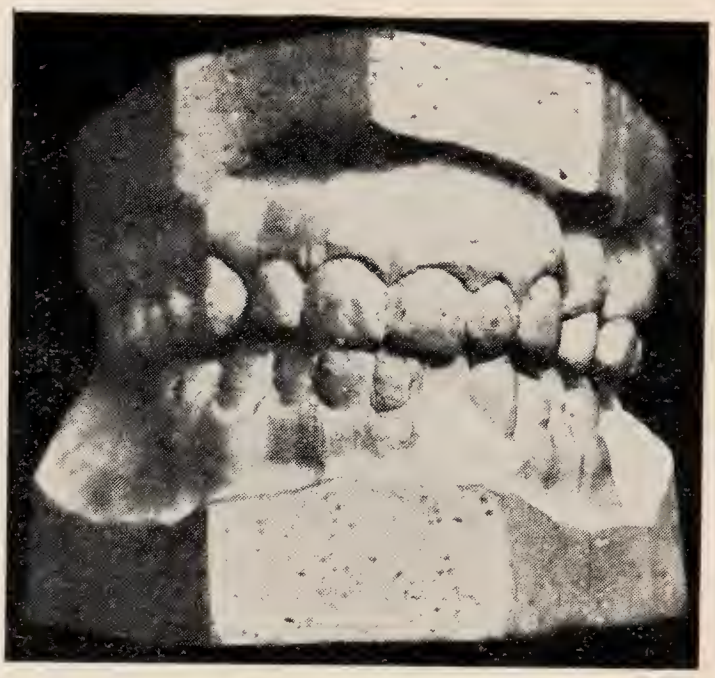


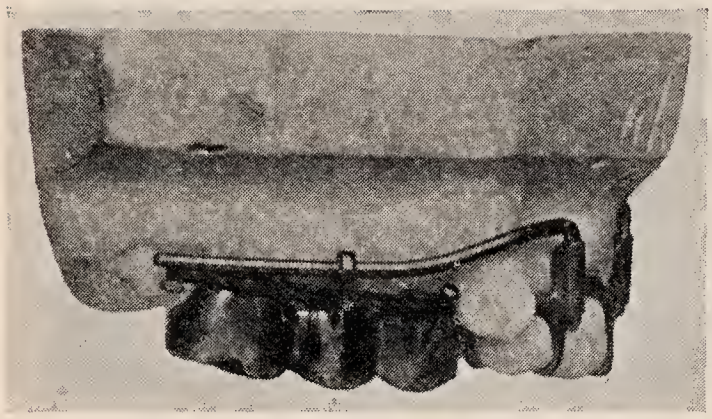
Fig. 4. Labial view.

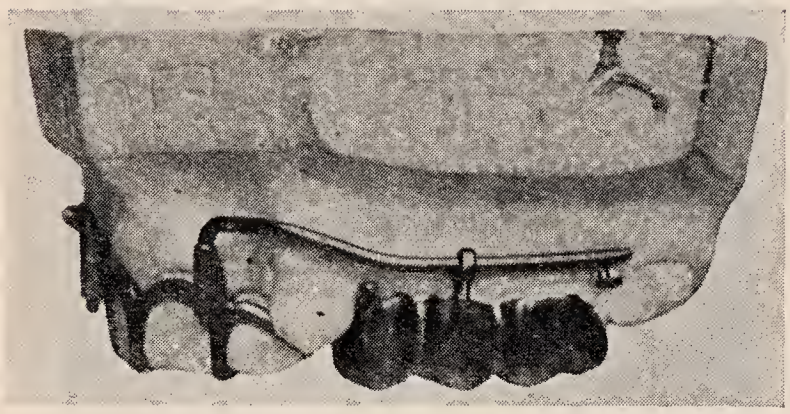
The edge to edge central incisor bite is not shown very well owing to the fact that the upper model has slipped forward slightly.

Fig. 5. Design to illustrate the contour of the palate.

A TREATED CASE.

By J. W. Mayer, L.D.S.





VERY PRONOUNCED CASE OF CLASS III.

By C. S. Morris, L.D.S., M.R.C.S., L.R.C.P.

With regard to the breathing, as far as the patient remembers, he had great difficulty in breathing through one nostril. As to whether there was an appreciable amount of difficulty in regard to the other nostril he would not be prepared to make any comment.

Observation of models of the mouth show it to be a case of Class I, with the central incisors biting edge to edge, and the lower incisor region somewhat crowded. The upper arch is an extremely well-formed one, associated with a normal palate. The case is an interesting one in its evidence in regard to the relationship of nasal obstruction to oral deformity and mal-occlusion. The interest, of course, lies in the fact that here one has a very definite history of a partial nasal obstruction—probably to the extent of 50 per cent. of complete nasal obstruction—over a period of years when the development of the facial bones was taking place with, I think one could well say, no detrimental result as regards the development.

A radiogram of the head taken antero-posteriorly shows the antra to be very well developed and the nasal septum to be almost normal, i.e. with only very slight deflection, such as is present in nearly all nasal septa.

Discussion.

Mr. Pitts said that this was one more case, added to a considerable number, which should make them sceptical of associating nasal obstruction and dental irregularity. There was undoubtedly some relation between nasal obstruction and the dental arches, but whatever that relation was, it was not an obvious or straightforward one. In this case the nasal obstruction, plus some other factor which was not yet discovered, was the responsible cause. Possibly it might be that sepsis was a factor. He drew attention to the fact that a very interesting study of the adenoid child, bearing upon the subject of Mr. Bocquet Bull's communication, had just appeared in the *Quarterly Journal of Medicine*.

Mr. H. Chapman endorsed the opinion of Mr. Pitts. Many members would recall the fact that the Society appointed a Committee some years ago to investigate the relations between nasal breathing and narrow dental arches, and the history was gone into as carefully as possible. It was found that those cases in which the arches were the best had the best history as regards mouth-breathing and *vice versa*, that is to say, the possessors of narrow arches were nasal breathers.

Mr. Warwick James said there was an asymmetry of the arch. He noticed that the third molar was present on the left side and not present on the right. There was asymmetry, but he thought it was due to the collapse of the arch on that side and the loss of teeth. With regard to the question of mouth-breathing, he thought that the term "mouth-breathing" was very unfortunate; the term "lips apart" would meet the case much better than a term which suggested mere mechanical breathing through the mouth. If the lips were apart the jaws were not closed as a rule, but they were deceived themselves sometimes when they spoke about mouth-breathing and thought of air actually passing through the mouth.

The President said that the point which Mr. James had just made was very important, because in Mr. Bull's case the lips were shut. He believed also that the term "mouth-breathing" was unfortunate; it was the lip effect that was the important factor.

Mr. F. B. Bull, in reply, said that he was sorry he had not been able to bring along that evening the radiograph showing the antero-posterior view of the skull. But he might perhaps bring this forward later before the Society in the shape of a casual communication. He believed it to have been the left nostril that was obstructed.

"EXPANSION OF THE UPPER ARCH IN A CASE IN WHICH ONLY THE LOWER ARCH IS UNDER TREATMENT."

By HAROLD CHAPMAN, L.D.S.

I REGARD this case, No. 587, as belongingto Class I, with a tendency to distal occlusion; regarding the overbite I express no opinion. The patient was 5 years 10 months old when the first models were taken and 6 years 8 months when the second models were taken. During three months previous to the taking of the second models the patient wore a lingual arch, gauge 20, with 3 loops, attached to the second deciduous molars. During this period there was an average increase in width in the lower dental arch of 2.6 mm. and in the upper dental arch of 2.3 mm.; no apparatus was used in the upper jaw.

MEASUREMENTS.

	E | E	D | D	C | C
October 31st, 1923 ...	39.6	33.7	23.5
December 16th, 1922 ...	37.4	31.5	21.1
Difference ...	2.2	2.2	2.4

	E | E	D | D	C | C
October 31st, 1923 ...	34.4	28.8	18.2
December 16th, 1922 ...	31.8	26.1	15.6
Difference ...	2.6	2.7	2.6

Average increase in width—of the upper arch, 2.3; of the lower arch, 2.6.

The PRESIDENT said that this case was most useful and he was sorry that Mr. Chapman did not put some theory forward as to why the upper arch had widened. Was it possible that the actual widening of the lower arch mechanically caused a widening of the upper? Perhaps Mr. Chapman could tell them whether the cusps were well marked.

Mr. CHAPMAN replied that the teeth occluded very well, and it was quite possible that the effect was simply due to the mechanical factor of the lower teeth acting on the upper ones.

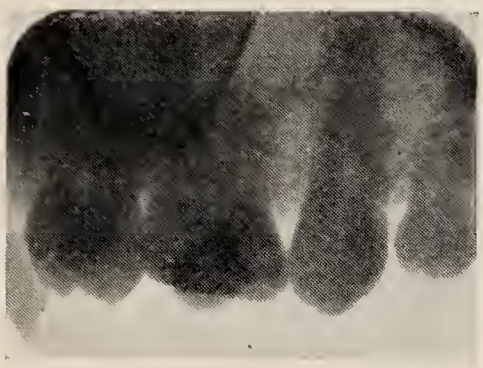
DELAY AND ARRESTED ERUPTION.

By EDMUND CLAREMONT, M.R.C.S., L.R.C.P., L.D.S.

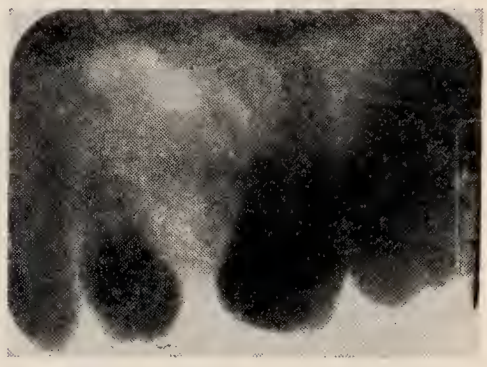
THIS case related to three members of a family who showed apparently well-marked signs of rickets. The father, whom we will call A in order to avoid confusion, died in 1913. There was a history of heart trouble and death was due to paralysis. He was operated upon thirty years ago when a growth in the lower jaw was removed, but no notes are available relating to that operation. This man A was married twice. By his first wife there was one son B who showed characteristic features such as

Communications by Edmund Claremont, L.D.S., M.R.C.S., L.R.C.P.

CASE OF ABSENCE OF PREMOLAR TEETH.



Upper Right.



Upper Left.

Lower Right.

Lower Left.

DELAY AND ARREST OF ERUPTION.

Portrait of "C."

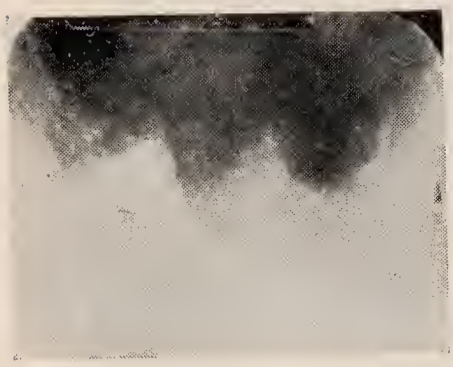
C, Grandson of "A." (Left side.)

C, Grandson of "A." (Right side.)

D, before the operation. One of the sisters, aged 42. Some rarefaction of bone round molars and premolars.

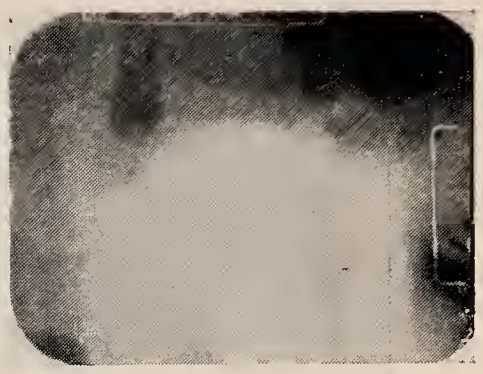
D one of the sisters, aged 42. Left side, X-ray showing fracture after operation.

DELAY AND ARREST OF ERUPTION—Case E.



Upper Left.

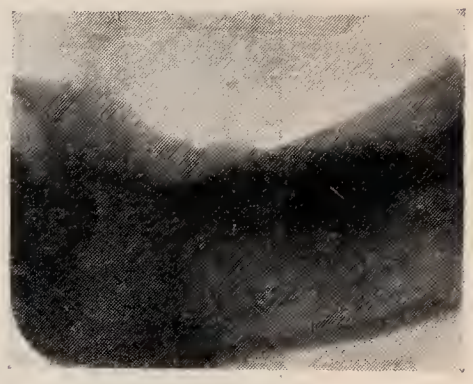
Upper Front Teeth.



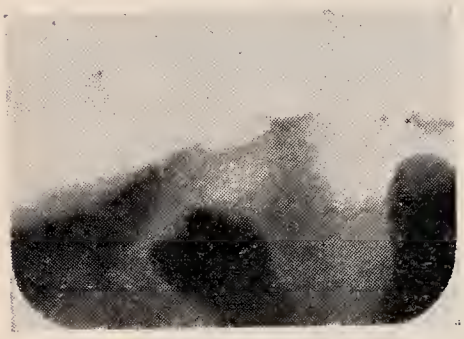
Upper Right.

Lower Right Molar.

Lower Front Teeth.



Lower Left Molar.



Lower Right Premolar.

Lower Left Premolar.

flattened bridge of nose, marked depression of antero-frontal suture, square head and prominent frontal bones. He was of small stature, and stated that he had only had a few teeth ; his health had always been good. This man B had two sons, the elder aged 23 and the younger 15. This younger son we will call C. From a photograph the elder son, aged 23, looked normal, though his teeth were very badly formed and were lost almost immediately after eruption, being apparently hypoplastic. A had ten daughters by his second wife, five of these dying in infancy. The cases showing delay and arrested eruption related to the boy C, grandson of A, and two of A's daughters by his second wife, whom we will call D and E. One of these daughters, D, aged 42, had only cut a few of her permanent teeth, these being hypoplastic. She had well-marked flattening of the nasal bridge, a typically rickety forehead, clavicles deficient at the sternal end, and was of very small stature. One or two teeth were removed at Guy's Hospital some years ago. The patient had worn full dentures over three partially erupted teeth for a long time. Some months before reporting in the Dental Department of the Bristol General Hospital she had complained of increasing neuralgia on the left side of the mandible, with an unpleasant taste in the mouth and with a sinus opening on the cheek in the region of the left lower canine tooth. The writer operated on her on December 4th, 1923, when a window was cut in the outer alveolar plate in the lower left molar region removing five teeth embedded in the bone. This bone was soft and carious, and the mandible was found to be fractured. The sinus on the cheek was freely opened up and scraped, the wound was washed out daily. There was very little discharge, and the sinus and wound in the mouth healed up well. This patient has two sisters resembling her, and two others apparently normal. One of the two sisters (E) who resembles her has never cut her second dentition, having worn full dentures for years and been absolutely free from any trouble with the jaws or teeth. She is very similar in appearance to D, having deficient clavicles and being of small stature. With regard to the boy C, the nephew of these two women, his dentition is very defective. The anterior fontanelle is still palpable. In him also there is a flattened bridge to the nose, the frontal suture very depressed, the head square, the frontal bones prominent, the stature small, the fourth fingers abnormally short and the arms normal. His clavicles are also ill-developed, there being a space of two inches between the end of the bone and the sternum. Chest expansion fair, air entry normal with no adventitious sounds. The spine shows slight scoliosis.

Discussion.

The President said that this was an extraordinarily interesting case, which made it all the more difficult to understand what was the cause of the non-eruption.

Mr. Pitts said that a good many years ago he had reported a case to the Odontological Section of the Royal Society of Medicine of a delayed eruption in a young man where a few teeth only had erupted. In that case there was very good bone indeed. The skiagraph picture and the notes of that case were included in the last edition of Sir Frank Colyer's book. With regard to the rachitic and possibly syphilitic history of Mr. Claremont's case, it would be interesting to know whether

a Wassermann reaction had been taken. He had seen a fairly large number of children with congenital syphilis, but he had not been able to find among them any evidence of delayed eruption, nor had he found anything satisfactory with regard to rickets. There were some cases of extraordinarily early eruption. But at the time when the eruption was taking place, among children of seven or eight years of age, the time for rickets had very often passed, and it was extremely difficult to obtain any history, the more so because mothers seemed to think that for their children to have had rickets was a stigma which must be concealed. He was not certain that rickets or syphilis were very closely concerned with eruption, but he did feel certain that there was an endocrine factor in eruption. It was very usual in these days to invoke the ductless glands, but the evidence did suggest that they were an important factor in bringing about eruption.

Dr. HOWARD CLARK referred to a note in the *British Dental Journal* for the current month which had a bearing on this subject.

The PRESIDENT said that it was now some years ago when he examined a good many children in Vienna who had rickets, and many of these children had lost their deciduous teeth very early and there seemed to be a delay in the eruption of the permanent ones.

Mr. CLAREMONT, in reply, said that a Wassermann was taken in these cases and was negative, but he felt, from what he knew of medicine, that that did not say very much. Another question was whether there was any idiocy in the family. All he could say was that the boy had a certain amount of mental slowness. He was also very deaf and altogether must be accounted as almost mentally deficient. It might be an interesting experiment to try some parathyroid.

Mr. CLAREMONT then described another case in which there was absence of premolar teeth. This related to a boy of 13 whose family had been coming up to the Bristol General Hospital for some years. The boy had had an excellent deciduous dentition, and only very recently had had trouble with three of his retained deciduous molars. When the bone was skiagraphed three or four of the premolar teeth were found to be absent. The right upper permanent canine was next to the first permanent molar. In front of them was the deciduous canine retained. He showed pictures and models of the case.

Mr. PITTS asked whether the deciduous molars showed any sign of absorption.

Mr. CLAREMONT said that the deciduous molars showed the normal amount of absorption.

A MEMBER said that it would be a very good thing if Mr. Claremont would present the actual photographs and models of his case to the Museum of the Society.

Mr. CLAREMONT said that he would be very pleased to do so.

Mr. LACEY asked whether the absence of premolars was in any way inherited. He had come across a case in which it was transmitted through three generations.

Mr. CLAREMONT said that in his case the remainder of the family had developed their premolars properly.

A TREATED CASE.*

By J. W. MAYER, L.D.S.

THE models are those of a patient aged 14 years 7 months. As you see there is a considerable lack of development in the front of this mouth, and as a result the biting edges of the four upper incisors are behind those of the lowers. You will, I think, agree, sir, that in treating these cases one has to avoid tilting the front teeth and also hampering the child's power of mastication whilst

* See illustration facing page 31.

" raising the bite." The apparatus used in this case consists of two parts (see illustration).

(1) A splint fitting the four incisors to which are soldered two parallel tubes projecting high up under the lip, and

(2) Caps covering the premolars and first molars to each of which is soldered a guide ring. Sliding through this guide ring is a rod, one end of which will fit tightly into the tube attached to the splint on the front teeth—the other end free and projecting towards the back of the mouth and shaped so that a rubber ring can be hooked through.

It can be seen that if a rubber ring be placed on the hook as above described and stretched so as to be attached to a fixed point in front, it will in contracting tend to slide the rod forward through the guide ring, ultimately pushing forward all four incisors since the other end of the rod is fixed tightly in the parallel tubes. The apparatus is much less apparent in the mouth than one would imagine. It is not simple to construct, but it has the advantage that once fixed in position with copper cement it will not come off, needs no adjusting, being automatic in action, the patient putting on fresh rubber rings each night until the front teeth are far enough forward.

Many of the spots on the teeth which are liable to become affected by caries are covered with copper cement, whilst as no part of the metal impinges on the gum it is hoped that by the average cleanliness of the patient, gingival irritation is reduced to a minimum. Pressure being directed high up on the root and distributed, tilting is avoided. It is felt that by putting pressure on the four front teeth splinted together as shown, it is most likely to stimulate the development of bone in the front part of the mouth.

Treatment was spread over nine months and no retention was used. The next slide shows result, and if the first models are placed so as to be compared in profile you will notice little or no tilting has taken place. I have to thank Mr. Jas. P. Brown for constructing the appliance. I am handing to you two facial casts, one of the patient before treatment and one after treatment, which shows modification has taken place in the features.

A VERY PRONOUNCED CASE OF CLASS III.*

By C. S. Morris, L.D.S., M.R.C.S., L.R.C.P.

He had previously shown this case before the Society in May, 1922. It was a case of a child, and the photographs showed how the upper lip fell well inside the lower lip and the considerable depression which existed in the maxillary region. A photograph of the child as she was at present, compared with a corresponding photograph taken two years ago, showed an enormous improvement of the mandible. There had been a considerable development in the alveolar part of the maxillary region, and the lips now met almost edge to edge. The age of the child was now 8; she was 6 when the case was first seen. He had asked the mother to make inquiries in her family as to whether there was any history, and she discovered a great-uncle who had this characteristic extraordinarily

* See illustration facing page 31.

well marked, but this was not a normal case of inferior protrusion. The child had a well-marked angle to the jaw and that part of the face was very well developed and of normal shape. As to treatment, he had adopted a suggestion made by Mr. Northcroft on the last occasion, and soldered on to the external arch a flange of German silver to take the pressure off the front lip. This was put on in May, 1922, and the child wore this device until the first week in February, 1923, and it had a very marked effect. He was gratified to find that her teeth started to move forward, and of course, at her age, her teeth were beginning to loosen and some part of the modification towards the end of the year was due to the fact of such loosening. But there was not the slightest doubt in his mind that the device which Mr. Northcroft had suggested had caused the moving forward of the upper teeth.

With regard to the lower teeth, he decided to extract some of the deciduous teeth in order to prevent the development of the mandible, and also to allow the lower front teeth to fall back from any pressure there might be from the lower lip. In December, 1922, therefore, he extracted the lower deciduous canines, and this caused the lower teeth to fall back, and the combined result was well exemplified in the photograph which he now showed of the child's appearance.

Discussion.

The discussion on Mr. Mayer's and Mr. Morris's communications was taken together.

Mr. Samuel said that for his own part he had been very diffident about carrying out treatment on the lines which Mr. Mayer had suggested. The occlusion in Mr. Mayer's case had not been upset at all, but the speaker could imagine that in certain cases this treatment might upset what had been normally a very good occlusion.

Mr. Lacey asked if skiagrams were taken showing the development of the bone.

The President asked whether the teeth were very loose during this movement. He thought it was a fact that if a bone were fixed and not allowed to have any function, some changes took place which were not for the good of the bone. Did any changes of that nature occur through fixing the bone so firmly in this appliance ?

Mr. Mayer, in reply, said that the uppers were actually behind the lowers. He was afraid he had not tested the vitality of the teeth, but he would do so. He did not know whether the teeth had undergone any considerable movement. They had undergone a relative movement, of course, but he was hoping to get actually a development of the bone in front, and to that end he had, rightly or wrongly, moved the bone forward. He did have a skiagram taken, but it was only taken about two days ago, and this case had been going on now for six months so that until some comparative skiagrams were available it was not of much value. As to the loosening of the teeth and possible interference with physiological function, that was the one thing he worried about more than anything else. He certainly thought there was a great risk in the fixing of these teeth. As a matter of fact the teeth were fixed, but one must remember that there were no means of testing the teeth, because he did not remove the appliance. The patient had not suffered any discomfort.

Dr. J. Sim Wallace showed a model of an unusual case of open bite, and asked for any enlightenment. The appearance was so marked that at first he thought it was a fracture at the first molar, but on second consideration he saw that there was not any fracture at all.

Mr. Chapman for Mr. J. H. Badcock, who was unable to be present, showed models and skiagrams of two cases of absence of all eight premolars.

In one case, a boy, $\frac{D \mid D}{D \mid D}$ had been lost and $\frac{E \mid E}{E \mid E}$ were present, firm and with roots unabsorbed. No family history of deficiency of teeth could be elicited.

In the other case, a girl, $\frac{\mid D}{\mid D}$ had been lost, $\frac{D \mid}{D \mid}$ showed extensive absorption and were about to be lost, $\frac{E \mid E}{E \mid E}$ were present but $\frac{E \mid}{E \mid}$ showed signs of absorption. In the mother $\frac{5 \mid 5}{5 \mid 5}$ were deficient and $\frac{E \mid E}{E \mid E}$ retained into adult life. The mother's aunt is said to have had the same condition but this was not verified.

Mr. Badcock also showed two models of Indian natives sent by Mr. C. F. Badcock of Madras; one showing two supernumerary teeth in the maxilla and four premolars on each side of the mandible (FIG. 1) and the other four premolars on one side of the mandible and three on the other (FIG. 2.) The Models presented to the Museum.

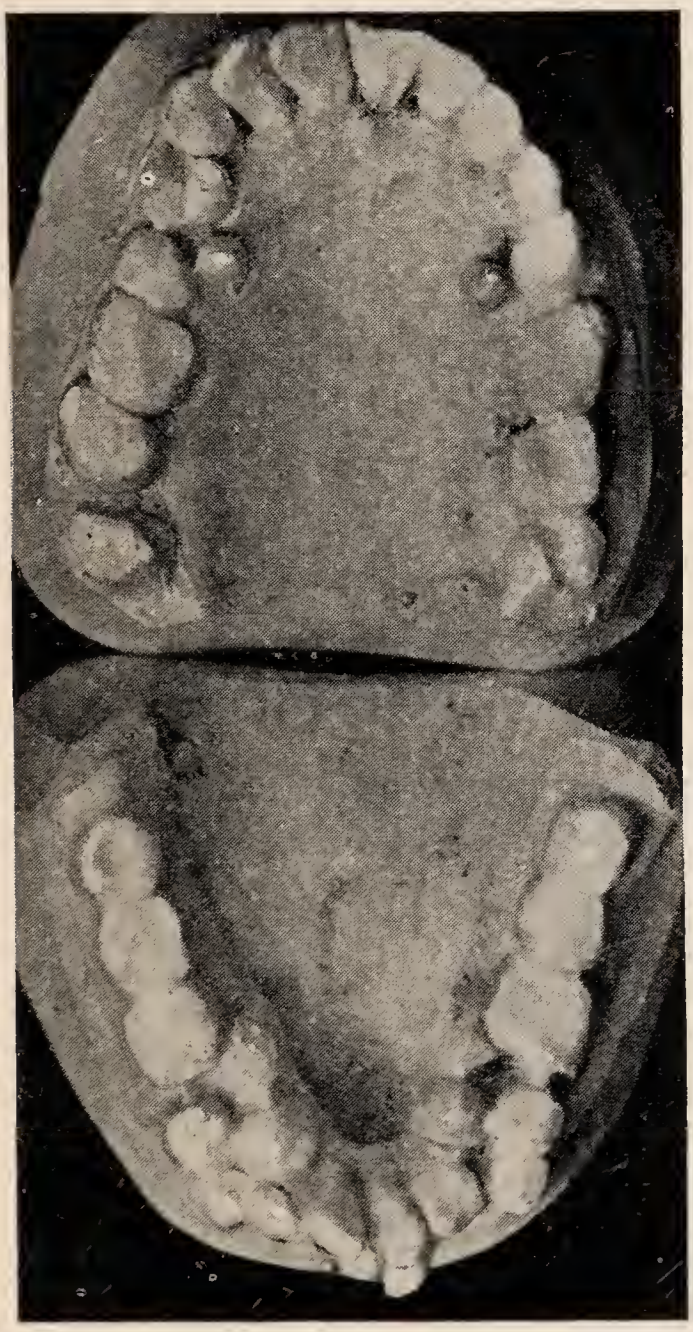


FIG. 1.

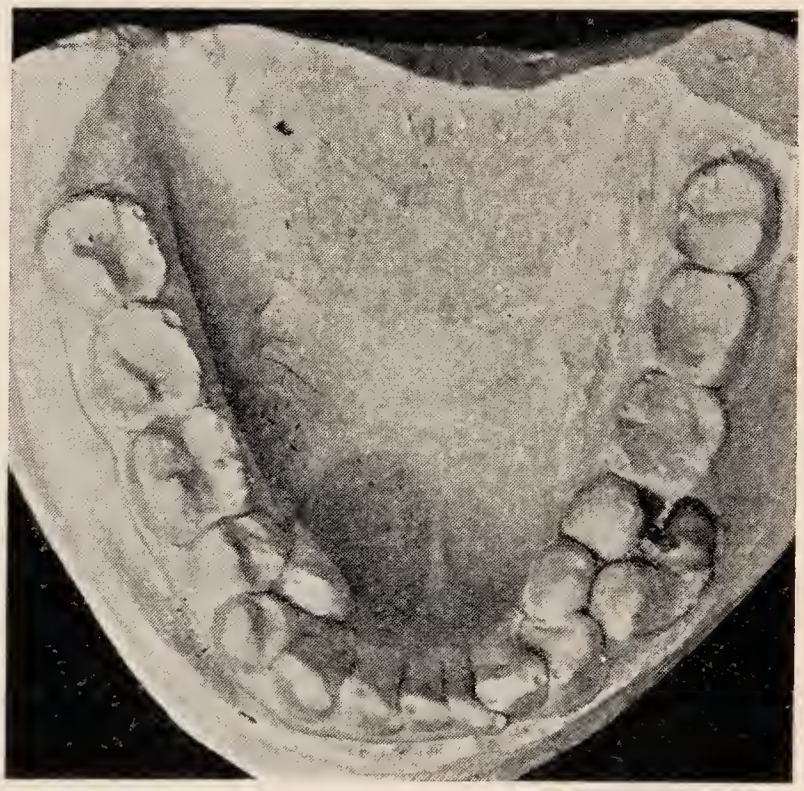


FIG. 2.

CLEFT PALATE CASES.*

ORTHODONTIC TREATMENT BY WILLIAM OVEY, L.D.S.ENG.

Case G. Vera H., aged 17.

Cleft palate and hare lip. Operation in infancy at Great Ormond Street by Sir Wm. Lane. Has received orthophonic instruction.

CASE G. COMPLETE CLEFT. FLAP OPERATION.

Orthodontic Treatment.—(*a*) Expansion by divided expansion arch, applied lingually, followed by Blue Island H.S. arch.

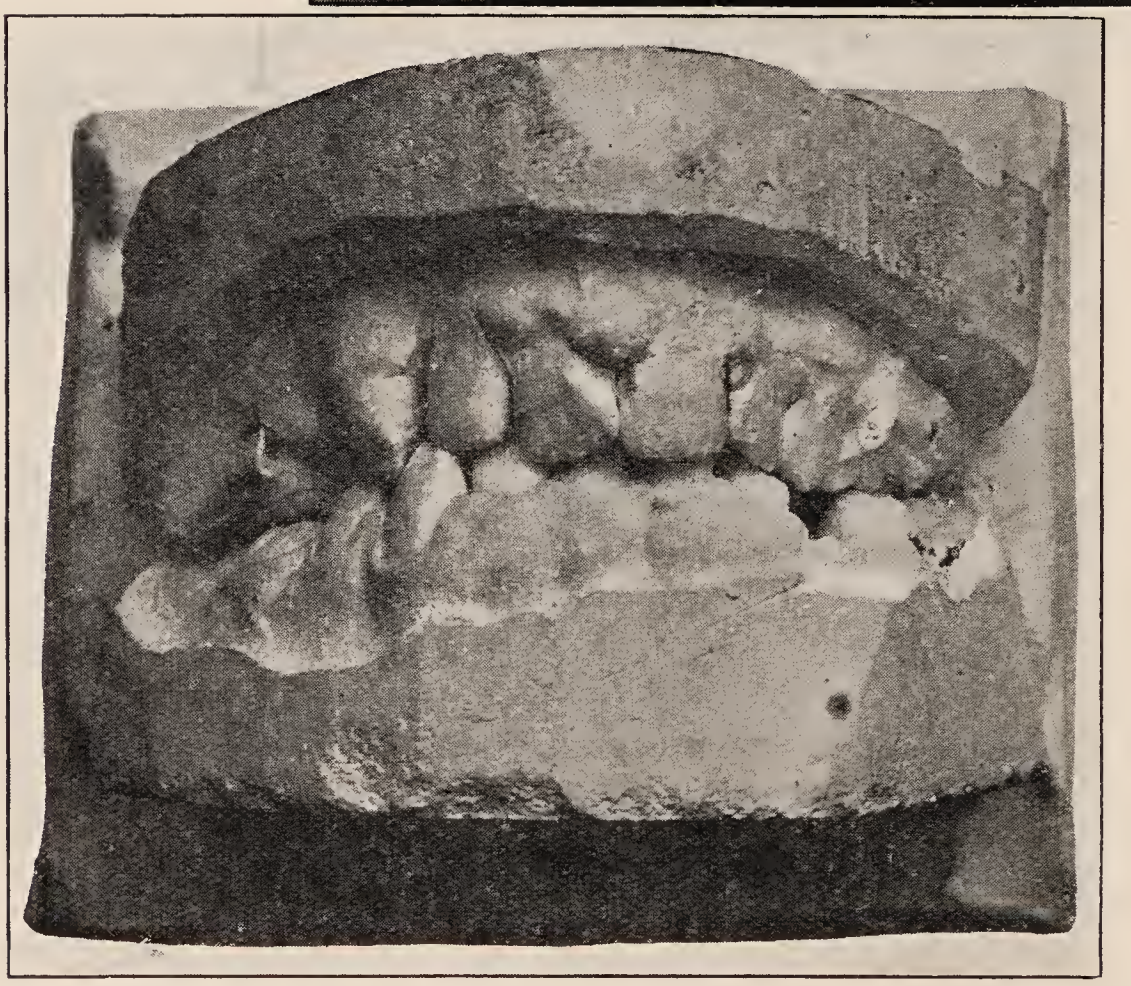
(*b*) The lower second premolars were extracted before eruption in 1916.

(*c*) Vulcanite retention plate with vulcanite peg to complete movement of $\frac{2}{2}$.

(*d*) Plain vulcanite retention plate worn two or three hours a day to prevent relapse.

CASE G.

SHOWS THE LACK OF OCCLUSION.



CASE G.

RESULT OF TREATMENT.

**Transactions* of the British Society for the Study of Orthodontics.

Case G.

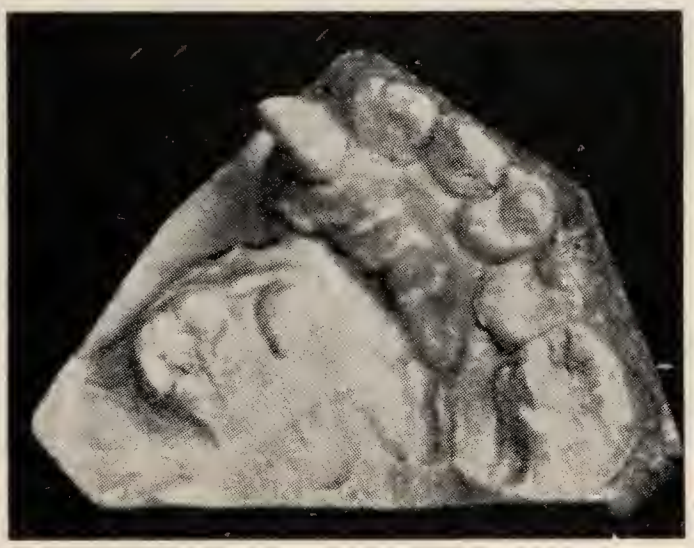
Result of Treatment.

Case H. Albert H., aged 12.

Unilateral cleft, hare lip. Operations at 12 days, 18 months, and 2 years, 10 months, by Sir. Wm. Lane.

Exhibited to show torsion of central incisor, which is a common accompaniment of hare lip.

Orthodontic Treatment.—Ribbon arch to be followed by denture when retention is complete.



Case H.

Case K. (*not illustrated*). Terence C., aged 10.

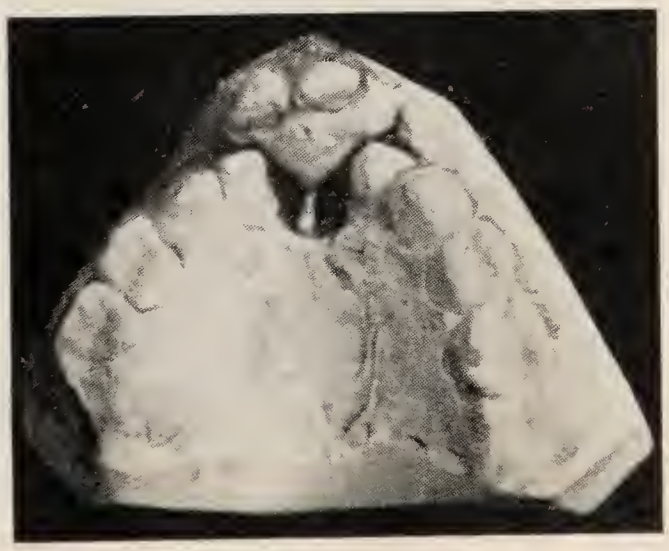
Cleft palate and hare lip. Operations by Mr. Hughes at Guy's Hospital. Palate at 3 months, lip at 6 months.

Treatment by means of ribbon arch recently commenced. This case shows the particular value of the ribbon arch in treating these cases. (Shortening of the arch is sometimes necessary.)

The patient also exhibits the habit of attempting to speak with the tongue lolling in the floor of the mouth, which is common in cases that have not received orthophonic instruction.

Case L. Gwendolin O., aged $7\frac{1}{2}$.

Double hare lip and complete bi-lateral cleft of central portion of premaxilla. Operations at Great Ormond Street by Mr. Tyrrell Gray at 10 months and 2 years. Expansion between $\overline{B} \mid \overline{B}$ has been obtained by a vulcanite plate with finger springs.



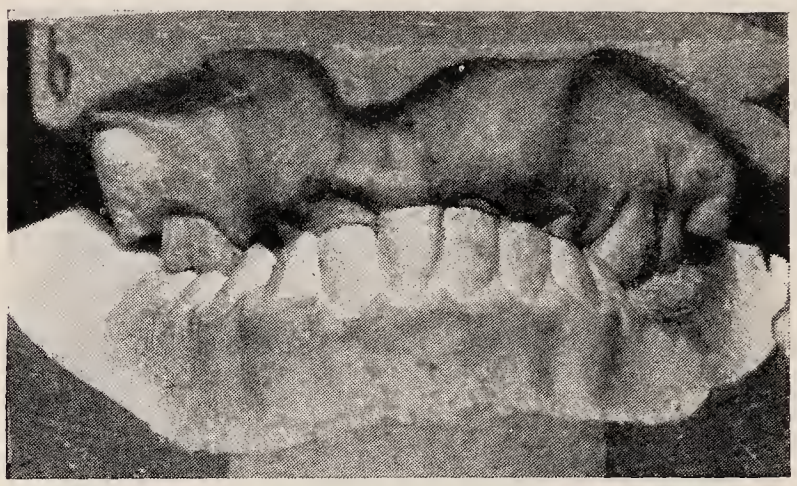
Case L.

Case M. Irene L., aged 11.

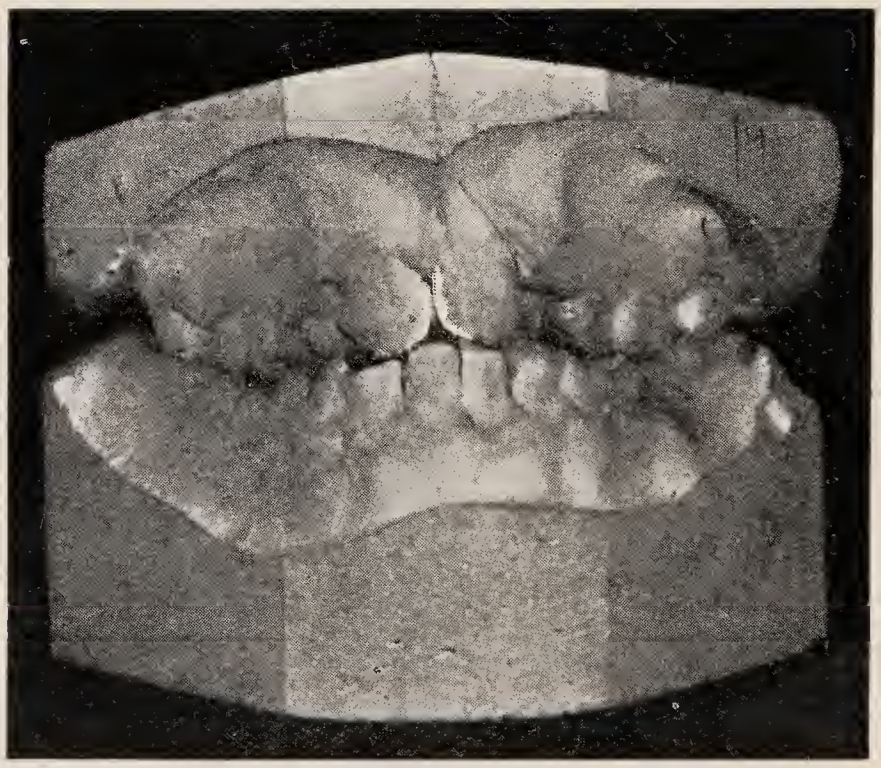
Flap operation at Guy's Hospital by Sir Wm. Lane. Under orthophonic instruction.

Orthodontic Treatment.—Expansion by means of ribbon arch (still in progress).

CASE M. IRENE L. COMPLETE CLEFT. FLAP OPERATION.



CASE M. SHOWING CONDITION OF OCCLUSION.



CASE M. SHOWING RESULT OF TREATMENT.

Most of the illustrations in the foregoing paper have been reproduced by courtesy of the *British Dental Journal.*

An Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W.1, on Monday, March 3rd, 1924, Mr. E. Sheldon Friel in the chair.

The minutes of the previous meeting having been read and confirmed, Mr. Schelling showed as a Casual Communication, "Observations on the Growth and Irregularities of Children's Teeth," by W. H. Mortimer, published in 1845, in which an early form of expansion arch was figured.

CONGENITAL ABSENCE OF THE TONGUE.

By Harold G. Watkin, L.D.S.

The author said that the case was that of a girl, the youngest of a family of six. The child was a bright child, with a splendid brain, and was nearly at the top of her class in school. To be strictly correct, the anterior two-thirds of her tongue were entirely missing, and a rudimentary posterior one-third was present. In the lower jaw three incisors and two molars were absent, and in the upper jaw one premolar and two molars were also absent. No extractions had been performed. The distance between the lingual surfaces of the two lower first permanent molars was only 16 mm., and the only permanent teeth erupted to date were the first lower molars, the right lower canine, the lower right lateral, and the lower left central. The others present, as shown by the X-rays, were the four lower premolars and the second permanent molars, but no wisdoms were present in the whole mouth. There was little doubt that it would be possible to expand the jaw sufficiently to allow them to erupt, and the radiographs showed that they were in a very good position. Apart from the smallness of the mandible (which might or might not be accounted for by the absence of the tongue) there was another most interesting feature, and that was the tremendous hypertrophy of the sublingual gland. The hypertrophy of the gland had made very good speech possible. There was one sound which the patient could not make properly, and that was the "hiss" which was common to the letters "c," "s," and "x." There seemed to be some inability to regulate the amount of protrusion of the gland to make that sound. The "t" and "th" were pronounced perfectly, as also were the other dental sounds. When the gland was at rest it subsided into the floor of the mouth and did not look abnormally large. He had a model, which he showed the members, which gave a good idea of the size of the gland. The model of the tongue and the gland had been done by measurement from the actual patient aged 12. The greatest width of the gland was 30 mm., which was nearly double the distance between the two molars, so that when the mouth was open the gland nearly covered the occlusal surfaces of the molars. Some three years previously the child had the appearance of a typical case of Angle, Class II, Div. I. (See first model Case I.)

Bands and arches had been fitted and intermaxillary traction had been used. The upper incisors had been moved posteriorly, and the lower incisors had been brought forward, so that the lower lip closed naturally over the labial surfaces of the upper incisors and the side view of the face left little to be desired. In conclusion, he added that the whole viscera was reversed, the heart being on the right side and the liver on the left. He also added

that if the Society desired it he could bring the patient up for the members to see.

A Treated Case of Excessive Thumb-sucking.

Mr. Harold G. Watkin then explained to the members a case of thumb-sucking which was a Class I of Angle, and was chiefly interesting because of the deformity. In the first model which he had of the case, on the right side there was only a space of 3 mm. between the anterior surface of the first lower molar and the distant surface of the lower canine, and both premolars were impacted, as was shown by the X-ray. On the left side the first premolar was erupted and the space for the second premolar was entirely missing, that tooth being impacted. The second X-rays, taken twelve months later, showed the teeth erupting nicely and that the bone was well formed. In the final model, the two lower centrals, laterals and canines were raised off the hard palate, and they occluded normally with the upper centrals, laterals and canines, which greatly improved the appearance because the lower lip closed normally over the upper incisors. Retention had been applied to the lower incisors by a lingual wire which was soldered to the two pinch bands on the lower canines, in the ordinary way. Although the lower second premolars both erupted lingually, they were at present in normal occlusion with the upper teeth, there being little danger of relapse. He said he was carefully watching the upper incisors, and there seemed to be no tendency for them to move forward as the lips were functioning normally and the patient was sleeping with her mouth closed. He concluded by saying that the child was 12 years and 8 months old, that thirty-five visits had been paid in twenty-two months—nineteen visits had been paid in twelve months between models I and II, and sixteen visits had been paid in ten months between models II and III—and that a new lower arch was fitted after sixteen months. He then showed the models to the members, and said he would leave them with the Society, for which the Chairman thanked him on behalf of the members.

Discussion.

Mr. W. W. James, after congratulating Mr. Watkin on his cases, asked whether he was sure that what he called sub-lingual gland was really sub-lingual gland or tissues on the floor of the mouth.

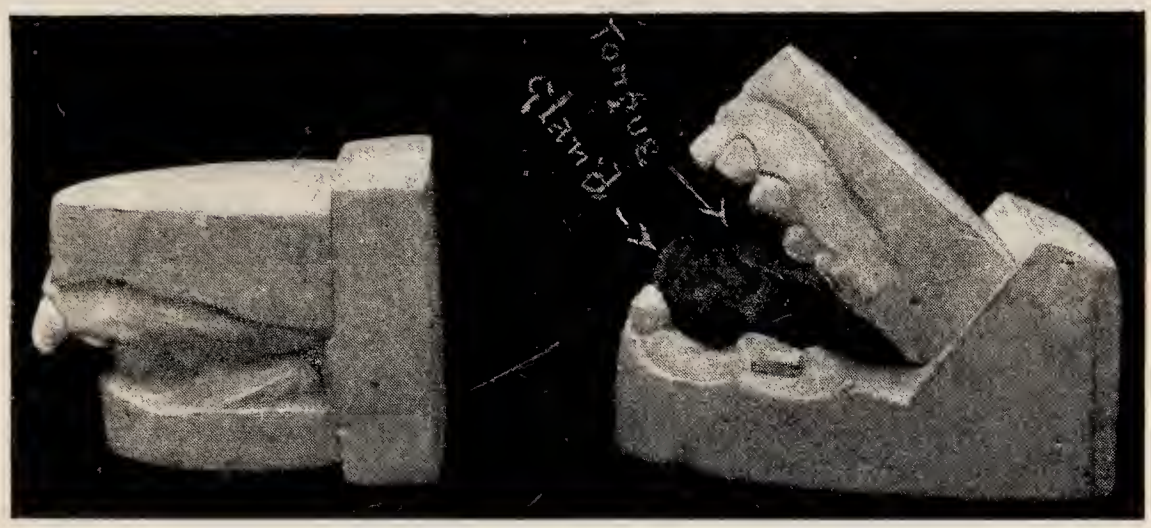
Mr. G. Northcroft asked if Mr. Watkin would deposit the models showing absence of the tongue in the Odontological Museum of the Society of Medicine at the Royal College of Surgeons.

Mr. Watkin said he would make another copy of them and let the Odontological Museum have one also.

Mr. Watkin, in reply to Mr. James, said that what he had called the sub-lingual gland had all the external appearance of the sub-lingual gland. In addition, Mr. Douglas Crawford, one of the leading surgeons in Liverpool, who was very interested in the case and who discovered the transposition of the viscera, was of opinion that it was the sub-lingual gland. At any rate, whatever it was, it was some tissue which Nature had provided for giving speech, and the child spoke remarkably well.

An Ordinary Meeting was held on May 12th, Mr. E. Sheldon Friel (President) occupying the chair.

TO ILLUSTRATE Mr. H. G. WATKIN'S COMMUNICATION.



Case I. Radicular Tongue.

Before treatment. After treatment.

Case II. Thumb Sucker.

A CASE OF DEFICIENCY OF TEETH AND OPEN BITE.*

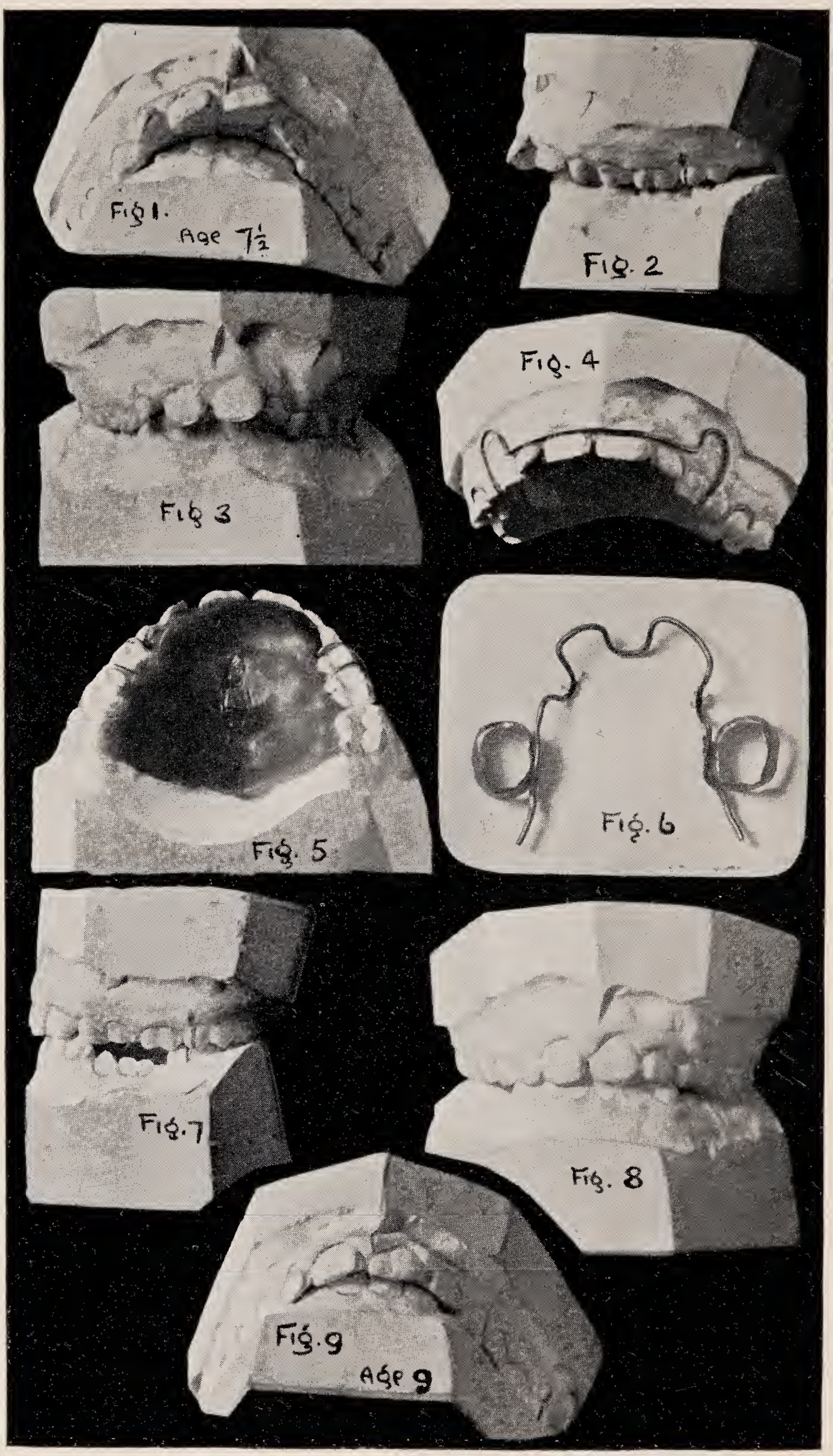
By L. E. Claremont, L.D.S.

The patient was a male aged nineteen. The maxilla showed transposition of the right upper first bicuspid into the position of the right upper lateral incisor. The lateral incisors were absent as revealed by X-ray photographs. The articulation was far from normal, the anterior teeth being practically edge to edge in occlusion. Grinding in the bite of the posterior teeth, and, at the same time, forcing the upper incisors slightly forwards by mechanical means was considered to be the only possible line of treatment to adopt, if indeed it were wise to interfere at all.

* *Transactions* of the British Society for the Study of Orthodontics.

A CASE OF POST-NORMAL OCCLUSION.

By H. E. Marsh, L.D.S.



A CASE OF POST-NORMAL OCCLUSION.

By H. E. Marsh, L.D.S.

This is a case of post-normal occlusion, where the lower incisors were biting up into the palate and the upper incisors showed much rotation, both arches being contracted.

Treatment was commenced at age $6\frac{1}{2}$, when the left upper central incisor was rotated as soon as its tip had erupted, by means of a spurred band, ligated to a small labial arch, supported by the upper second deciduous molars.

At age 8 a lower lingual arch, with Young Angle locks, was used and one anterior and two lateral loops, for expansion.

The upper arch was expanded by means of a Badcock plate with inclined plane, and labial wire of platinised gold, gauge 21, with two loops opposite the temporary canines. This served to jump the bite, correct the overbite, retract and rotate the upper centrals and laterals, vulcanite being cut away from behind these teeth from time to time and the labial wire adjusted accordingly.

Illustrations.

Fig. 1.—Showing incisors biting on cingula and rotation of upper incisors.
Fig. 2.—Showing the post-normal occlusion.
Fig. 3.—Front view.
Figs. 4 & 5.—Badcock plate with labial wire and inclined plane used for upper.
Fig. 6.—Lingual arch used for lower.
Figs. 7, 8 & 9.—Front and side views after treatment. Duration of treatment twelve months. Appliances being worn passively still.

Casual Communications.

Among the youngest cases treated, Mr. George Northcroft showed that of a female patient for whom treatment of an incipient Angle's Class III was undertaken by bringing out the upper incisors over the lower. This result was obtained by fitting screw bands on the E's and screwing out the labial arch by nuts, having ligatured all four incisors thereto.

The treatment was completed in one month, and no retention used.

Models of the same patient at the age of $12\frac{1}{2}$ were shown, having normal antero-posterior occlusion.

Mr. H. G. Watkin exhibited "A Simple Method of Recording Facial Contour."

A shadow of the profile of the patient is cast on a sheet of white paper and the outline sketched on the paper with a soft blacklead pencil.

A source of light from a *point* is necessary. The best light is undoubtedly a small electric arc-lamp, but other suggestions are a "Pointolite" lamp, a six-volt motor-car headlight lamp (not enclosed) or an acetylene lamp with a single small flame. If the surgery can be made very dark a wax candle could be used. The best arrangement in most surgeries is to turn the dental chair through 90 degrees, as this generally allows a greater distance to be obtained between the light and the patient. For the white paper an artist's sketching block is very convenient. Of course, the shadow is a slightly enlarged reproduction, but if the distances between light and patient and

patient and paper are kept constant, the comparisons of the actual sketches will be faithful.

If thought desirable, it is quite easy to reduce the enlarged picture to the natural size by means of a pantograph.

Mr. HAROLD CHAPMAN showed "A METHOD OF MAKING MOLAR BANDS DIRECT TO THE TOOTH."

The tooth is separated and then measured by means of a soft copper strip and band-forming pliers. The copper strip is cut and laid out flat to give the correct circumference of the tooth. A piece of band material is taken and cut on the cervical edge to the length of the copper strip, with a slight excess for the overlap; the occlusal edge of the band is always shorter than the cervical, the difference depending on the contour of the tooth. The band is soldered with wire solder, shaped with pliers and tried on the tooth; it should fit sufficiently tightly not to go quite home, the band being forced on the tooth with Pullen's band driver, or a thin flat piece of wood, such as a tongue spatula. If too tight the band is stretched at the joint with pliers S.S.W. No. 130, to obtain the required tight fit; if too loose it must be shortened. The band is removed from the tooth, festooned medially and distally and given a belly buccally and lingually, the amount depending on the contour of the tooth, but in any case exceeding this to permit of an extra thickness of cement on these two sides. This bellying or contouring will permit the band to be forced into its final position, being driven down medially and distally with a short length of orange-wood stick, lying along the medial and distal edges of the band alternately. If the fit is now accurate the band is again removed and the occlusal edge turned in to facilitate adaptation to the occlusal margins of the tooth with band adapters; this is the final step in obtaining a well-fitting band. The last stage may be done immediately after the bellying operation; it may sometimes be desirable to slit the occlusal edges in one or two places and overlap the cut ends to get good adaptation. When this has been done the cut edges, or overlaps, are united with solder.

Mr. C. S. MORRIS showed "PLAIN RETENTION BANDS FOR MOLARS AND BICUSPIDS."

The band is made of material $\frac{3}{16}$ in. wide by 33 thick, and made with 1 mm. overlap, Brown and Sharpe gauge. Sets of these bands are kept ready made, in length varying from 24 mm. to 39 mm. long.

The tooth, already separated from its neighbours, is measured for size by trying one of the already made bands. This must fit fairly tightly, so as to be moulded to the tooth. It is forced down by the child biting on a thin piece of basswood. It should be forced down till the top edge is a millimetre above the sulcus, at the mesial and distal ends. It is then burnished into these sulci, and buccally and lingually. This will leave the metal sticking out at the corners.

The band is now removed, and these corners are split down about $\frac{1}{16}$ in. or more, as necessary, to get the contour. It is placed back on the tooth and its corners burnished to the tooth so as to make them overlap, and all the top edge is burnished to get as accurate a fit as possible.

An impression is taken now, and all attachments to be soldered to the band are made on the model. When this is done, the splits on the corners are soldered up, the band invested on wet sand, and solder run round the whole top burnished edge of the band about $\frac{1}{16}$ in. wide. This makes the band quite rigid, and also—most important—prevents the patient from turning the edge, and so gradually peeling the band off.

In deciduous molar bands, a small seam of solder is run along the bottom edge, at the anterior buccal angle, internally, about $\frac{1}{8}$ in. long and $\frac{1}{2}$ mm. wide, which when forced on make the bands grip under the approximal contour.

Mr. L. F. Fouraker described the case of a patient named E. W., present age 13 years 2 months. Badcock plate fitted July 18th, 1922. Buccal wire used to pull back upper fronts. Lingual arch (upper and lower) fitted January 16th, 1923. Intermaxillary traction commenced December 11th, 1923.

Occlusal and General Observations.

Class II, Div. I. $\overline{6}|$ had moved forward on account of early loss of $\overline{e}|$. Excessive overbite. Grandparents have similar occlusion.

Gums.—Gingivitis commenced generally before treatment was commenced and has persisted, but seems to be gradually getting better.

Caries.—All first permanent molars were carious.

Mouth-breather until about May, 1923. Adenoids were removed in 1921. Bottle-fed on Allenbury's food for the first eighteen months of life.

Present Diet.—Breakfast: Force, bacon, bread and butter; nothing to drink. Lunch: biscuits and milk. Dinner: plenty of meat and vegetables, milk and suet pudding. Tea: bread, butter, jam, cakes (only home-made), milk to drink. Sweets and fruit: few sweets (chocolates), bananas chief fruit. Mastication is poor.

Habits.—Comforters, thumb-sucking, etc., none.

General Health.—Has had swollen glands in neck which were most enlarged in 1919. Has had measles. Otherwise the patient at present looks very healthy, although she seems to be rather on the tall side for her age.

Mr. Maxwell Stephens showed a small upper expansion plate which had been used to commence treatment of an incipient case of Class III (Angle's) at the age of 3 years 10 months. The plate consisted of a vulcanite base in the vault of which was set a spring in the form of a staple with a loop pointing backwards, and a guiding rod forward to steady the halves in action. The object aimed at was to secure expansion of the anterior two-thirds of the arch, and thus by pushing the incisors and cuspids outward, to induce the mandible to slip back from the forward position into normal occlusion again; this was entirely achieved.

An Ordinary Meeting was held on October 6th, Mr. E. Sheldon Friel (President) occupying the chair.

"TORSION: SOME FACTS AND PROBABILITIES."

By J. W. Mayer, L.D.S.

Some time ago the Secretary of this Society asked me if he could include my name among those of junior members who were to read short papers here. My instinct told me that my safest plan was to compose a courteous letter of refusal; but so pleasantly had the request been made, I hardly cared to shirk what, after all, is a common responsibility. Besides, however unworthy of the honour, it is, to say the least, a considerable privilege to address a meeting here, where one can count many of the eminent men of Europe amongst one's predecessors.

I shall be glad if you will allow me a considerable amount of latitude in dealing with this subject, for many of the observations I intend to make will be applicable with equal force to stresses other than torsional; but since the principles underlying the

correct application of all stresses to teeth are identical, it is difficult, when dealing with the subject on the lines I have chosen, to confine my remarks to any particular variety of tooth movement. Still, however inadequately I may deal with the subject, I believe it to be worthy of the deepest consideration by the members of this Society, for there is a certain amount of conviction amongst dentists, medical men and even the public, that the movement of teeth by orthodontic appliances can cause a predisposition to pyorrhœa. It is very difficult to present scientific data to prove the truth of this assertion, but many of you will agree that such a statement is not an exaggeration, and you would not care to deny the possibility of peridental degeneration being caused by orthodontic treatment as practised throughout this country. I certainly could not exonerate myself from such a charge, and it is because, and in spite of this, that I have chosen one aspect of the subject of tooth movement to talk about to-night.

Of those movements of teeth which are commonly carried out, rotation is perhaps the most difficult and most dangerous, and it does not appear to be easy to avoid by pre-emptive treatment such malpositions of teeth as will require the application of torsional force for their correction. Lack of room will often cause a tooth to take up an abnormal position, but it is by no means certain in such cases that we can by early expansion or extraction ensure complete eruption in correct alignment.

In dealing with a subject of this nature one is tempted to confine oneself to an examination of the merits of the different methods of applying torsional force, but although I hope later on to be able to say a few words about such a popular topic, I am first going to put before you some of the theoretical aspects of the subject, for we must remember that by far the greater part of orthodontic treatment in this country is carried out by the dental practitioner, who almost invariably concentrates on the knowledge of apparatus and is inclined to neglect the anatomical and physiological considerations underlying tooth movement. Too often, I fear, the result of this is that we are inclined to move teeth with insufficient caution, satisfied if we are able to procure a pleasing result as soon as possible. The approval of parents is of course to be desired, but we shall certainly have failed if our treatment ends in early peridental disease, as the penalty of trying to satisfy the natural anxiety of patients to see quick results.

May I therefore, with the powerful aid of dental histologists and by the courtesy of their publishers, endeavour to show what happens to the relevant tissues when we move teeth, and what must be avoided if we are to give our patients the best service. I fear in doing so I shall repeat what to most of you here will be but elementary knowledge ; I hope that you will not be bored by my recapitulation.

When the tooth at first erupts through the gum the alveolus is much larger than the root and the fibres of the peridental membrane are very long, but as the tooth moves into occlusion the alveolus is reduced by the formation of bone on its walls and the size of the root is increased by the formation of cementum, layer after layer, on its surface. In this way the thickness of the peridental membrane is reduced. I have to show you two pictures from Noyes'

"Dental Histology" both of which were photographed with as nearly the same magnification as possible. The first is cut from the young temporary tooth of a sheep, the second from a temporary tooth which has been in position and function for some time. In comparing these you have noticed the difference of the cementum and the peridental membrane, and you will see that between these two periods in the life of the tooth considerable changes have taken place. These changes, I suggest, are of great importance, for it would seem that if we could devise a suitable apparatus it would be best, when rotating teeth, to commence our treatment as soon as possible after the tooth has pointed through the gum, for then the tissues are in their most changeable condition, and are therefore more likely to react favourably to change due to stress. We must presuppose, when there is crowding, that room will be provided at the same time to allow for correct alignment to be taken up by the tooth. Also it is of course essential that the eruption of the tooth shall not be interfered with by any stress having an elevating or depressing action. It is also evident that any force applied must be infinitesimal in amount—and rather in the nature of a stimulus than a pushing force.

I have often wondered if a satisfactory result could not best be obtained by placing a fixed and stationary inclined plane against the instanding corner of the tooth, so adjusted that the forces causing eruption would propel it to its correct alignment. In such an event no external force would be used at all. But I must admit that so far I have not tried such a mode of treatment. But now, when the opportunity presents, I *do* apply torsional pressure as soon as I can after the tooth peeps through the gum, and I have no doubt but that some here have already chosen to commence treatment at this early stage rather than wait, as is commonly done, until the complete eruption of the tooth, in the hope that pressure from lips and tongue will provide a happy solution of the problem. Perhaps they will be good enough to give us their views and the benefit of their experience of what appears to me to be a rational procedure.

Whatever the merits or demerits of very early treatment may be, in most of our cases we are called upon to deal with teeth already fully erupted and established in incorrect positions. If we visualise such a misplaced tooth, we think of it held in position by the peridental membrane, the fibres of which are embedded in the cementum of the root at one end, and which run from the root to be attached at their other extremities to the alveolar bone and the surrounding tissues. Bone, peridental membrane and cementum are connective tissues, and connective tissues are very adaptive, and are constantly changing to meet new conditions, apart from those caused by mechanical interference, for we must remember that normally teeth move very slightly throughout life. There are, however, two very important factors to be considered if connective tissues are to successfully undergo an adaptive modification; one is the provision of proper food material, and the other the removal of waste products. I shall refer to this again when I deal with the peridental membrane. I will now deal in a little more detail with the changes that probably take place in these connective tissues in response to stresses. The cementum

has attached to it the fibres of the peridental membrane, which hold the tooth in position. These fibres are bolted to the cementum by the action of the cementoblasts—specialised cells of the peridental membrane, which first build up a matrix around the fibres and afterwards calcify both matrix and fibres.

Throughout life there is a deposition of cementum on the root, layer after layer, so that a tooth sixty years old will have a considerably larger number of layers than a tooth twenty years old. Noyes remarks that "It is important to remember in connection with this formation of cementum that the teeth move, more or less, under the influence of natural processes throughout life, and that every slight change in position must be accomplished by the formation of a new layer of cementum, to reattach connective tissue fibres in new positions or to adjust them to new directions of strain . . . and often before an addition is made there is an absorption of enough of that cementum already formed to at least cut off the fibres." It follows, therefore, if Noyes' assertions are correct, that when a tooth is rotated, it is not to be presumed that the fibres of the peridental membrane undergo a contraction on one side of it and an elongation on the other, but that they remain unchanged except for the fact that they take a new grip of the cementum to allow the tooth to take up a new position, and, of course, movement must not take place faster than the adaptive modification between peridental membrane and cementum, otherwise the tooth will become loose, and its attachments suffer such a shock, from which they may never recover. If such an unfortunate happening should take place our only hope would then depend on a prolonged splinting, such as we get in a lengthy retention, and even that might not suffice to heal the breach of attachment we have caused.

In ground sections the more imperfectly calcified fibres only can be seen, and only then if the section happens to be cut in their direction. This slide, another reproduction from Noyes' book, shows several layers next the dentine, in which no fibres appear, and then in several layers fibres are plainly seen and finally the surface layers show no fibres. This, Noyes considers, probably means that before and after these layers were formed there was a change in the position of the tooth, and the fibres were all cut off in this area and reattached in a new position, adapting themselves better to the new direction of strain. We can see therefore that very sensitive and definite adjustments *can* take place between the cementum and the peridental membrane, which have considerable value to us and which must have every opportunity of functioning under the best conditions if we are to successfully rotate teeth. And we see that a thickening of cementum need not necessarily be pathological—a matter of some importance when we have to interpret a radiogram of teeth which have undergone orthodontic treatment.

When we come to consider the changes resulting from orthodontic interference, which take place in the bone surrounding the teeth, we become involved in a very difficult and controversial subject. The best we can do as dental surgeons is to examine the investigations of workers in this field of research for the most possible explanation of our clinical experiences. Orthodontists base their

expectations of a beneficent reaction in alveolar bone to stresses on a belief in the correctness of Wolff's law, which Sir Arthur Keith enumerates as follows: "Every change in the form and function of bones, or of their function alone, is followed by certain definite changes in their internal architecture, and equally definite secondary alterations in their conformation, in accordance with mathematical laws." We might make this definition more topical by saying that if stress be transmitted to alveolar bone we can expect the cells of that bone to rearrange themselves in a definite way, depending upon the direction from which the stress is transmitted." The truth of Wolff's law has lately been disputed, but that we can reasonably expect a satisfactory reaction in bone as a response to stress properly applied, seems evident, when we consider the results of research work on this subject, obtained by Oppenheim. His conclusions are of such fundamental importance that I will briefly describe his experiments.

Orthodontic appliances were placed on the teeth of young baboons and varieties of movements were carried out, some under a very gentle and gradual pressure, others under intense pressure, whilst other teeth were not moved at all, so that a check on the experiments could be made. The animal was then killed and histological sections taken. Oppenheim came to the conclusions "that bone tissue, be it compact or cancellated, reacts to pressure by a transformation of its entire architecture—the newly formed bony spicules being arranged in the direction of pressure. This transformation results only upon the application of very slight physiological-like stresses. Should the stress used be considerable, there will be an entire absence of such bone formation, whilst the blood-vessels of the peridental membrane appear to suffer degenerative changes," and it is of course upon the wellbeing of these blood-vessels that the formative power of the osteoblasts and other cells depend.

I have been kindly permitted to show these slides, which illustrate the changes described. The original appear in McKay's "Applied Orthodontics."

(1) Normal tooth.
(2) Labial side after gentle pressure.
(3) Lingual side after gentle pressure.
(4) Labial side after intense pressure.

These experiments seem to justify Wolff's law, at any rate as applied to stresses on alveolar bone, and they emphasise the importance of using only the mildest pressure in our work. There are, however, other considerations which must influence us. We have to take into account that the bone-forming power of different individuals varies—that in some mouths the proliferating potentiality of the osteoblast is exuberantly vigorous, whilst in others it is relatively feeble. We note the result of this clinically when we find that in some mouths teeth are particularly slow to move in response to our treatment, and in such cases on no account should a greater stress be used to encourage more rapid movement.

Again, it has been proved that mechanical fixation will cause bone atrophy, and in the degree that we limit the physiological movement of the teeth do we create conditions favourable to atrophic changes in the supporting alveolar bone. This fact

materially influences the design of apparatus and causes one to look with suspicion on the use for long periods of some types of fixed apparatus.

The peridental membrane gives us the greatest anxiety in any tooth movement, for it is very susceptible to degenerative changes. It is frequently stated that traumatic occlusion and the presence of faulty contact points will most certainly lead to early pyorrhœa, and on the correction and elimination of these ever-present evils depends the *raison d'être* of the orthodontist, for he is not entirely a beauty specialist. It is futile, however, to correct malocclusion for the avoidance of peridental disease, and in so doing to cause injury to the peridental membrane; yet I doubt, especially under the present conditions of practice, if the wellbeing of this important structure gets anything like the consideration it deserves. If the tooth under treatment becomes tender or loose, are we as anxious as we should be?

Looking at the problem of degeneration of the peridental membrane from our particular point of view, we have to bear in mind two dangerous possibilities—one, that we may injure the epithelial lining of the gingival trough, thus exposing the membrane to infection, the other, as we have already seen, that we may by undesirable stresses inhibit the proper circulation of the blood, together with the elimination of waste products via the lymphatic vessels. Such a disturbance would have far-reaching effects, for we must remember that the functioning of the osteoblasts and cementoblasts, as of all cells, depends on suitable food supply and drainage.

The facility with which inhibition can be caused is realised when we reflect that the blood and lymphatic vessels ramify between the fibres which, as we know, pass in all directions. It is unnecessary to describe in detail the six different groups of fibres and the direction of their courses, but mention must be made of the tangential fibres at the apex of the root. It is considered that they specially provide against rotative movement, and I can hardly dispute the opinions of the eminent histologists who hold this view, but on reflection we can hardly see why these fibres should be specially provided for this purpose, for it would seem that were they not present the other fibres would be sufficient to prevent rotative movements. Mummery mentions that the apical fibres form with the interfibrillar tissue a cushion or pad, on which the tooth rests, and it may be that this is their more important function. As to changes which take place in the membrane itself in response to stress, the conclusion I have rightly, or wrongly, come to is that the less change the better, or, to put it another way, if the movement has been properly carried out there should be very little change at all, except, as we have seen, at the junction of the membrane and the other tissues with which it comes in contact.

I have dealt very superficially with this important side of my subject, but sufficiently, I hope, to make evident those theoretical principles which are all-important, if we are to obtain satisfactory results from our practical efforts. For a moment we are filled with a certain amount of consternation at the difficulty of producing satisfactory tooth movement, but we can take heart from the fact

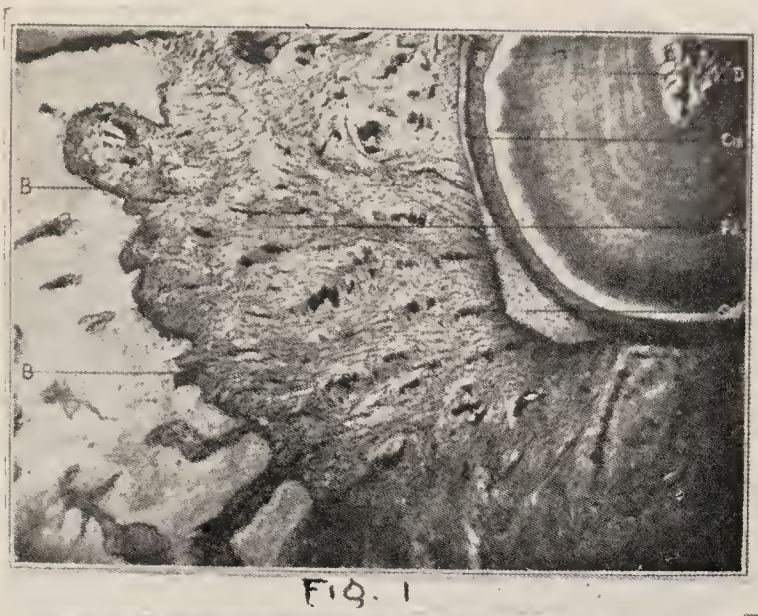


Fig. 1

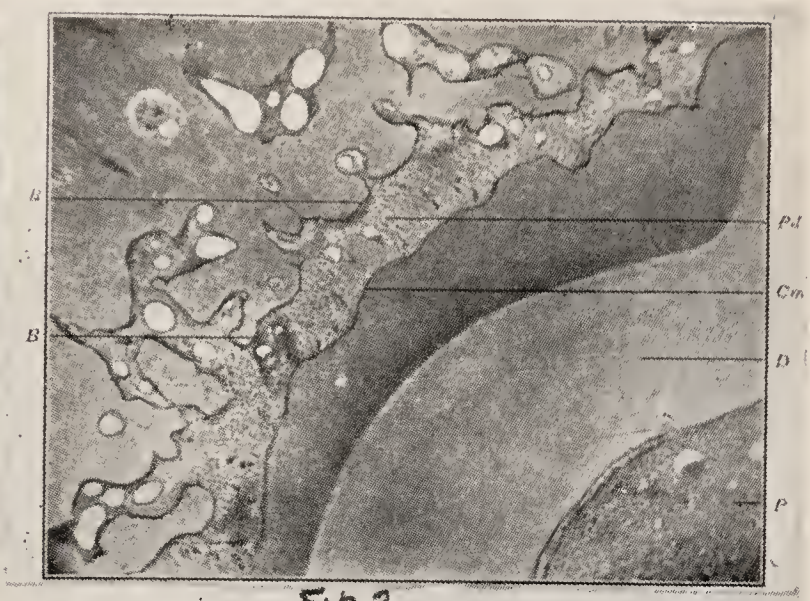


Fig 2

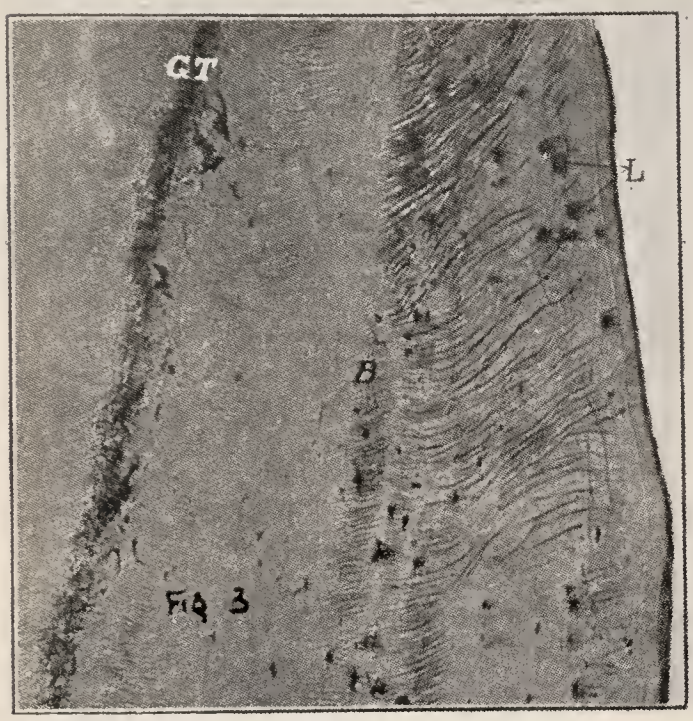


Fig 3

Fig. 4

Fig 5

Fig 6

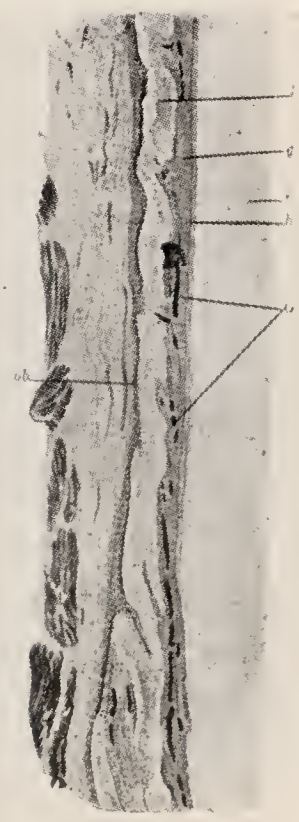


Fig 7

Fig. 8

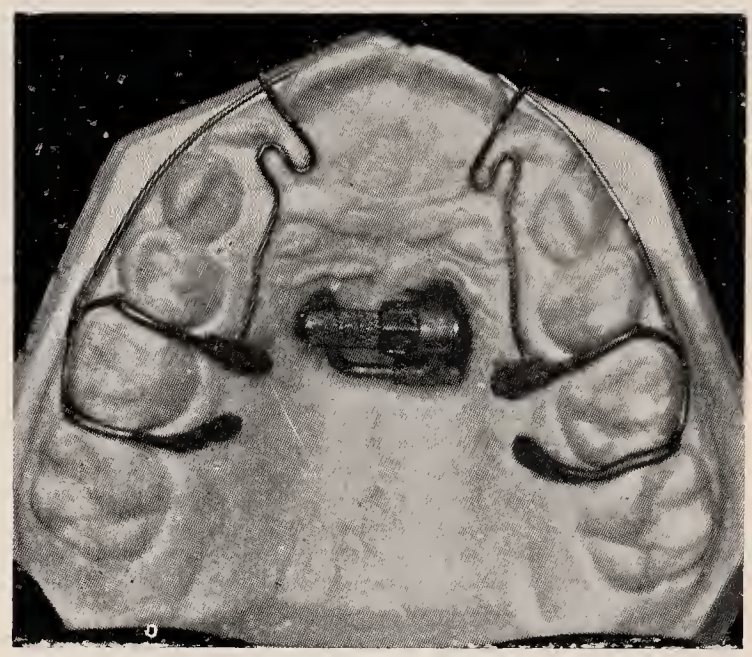


Fig. 9

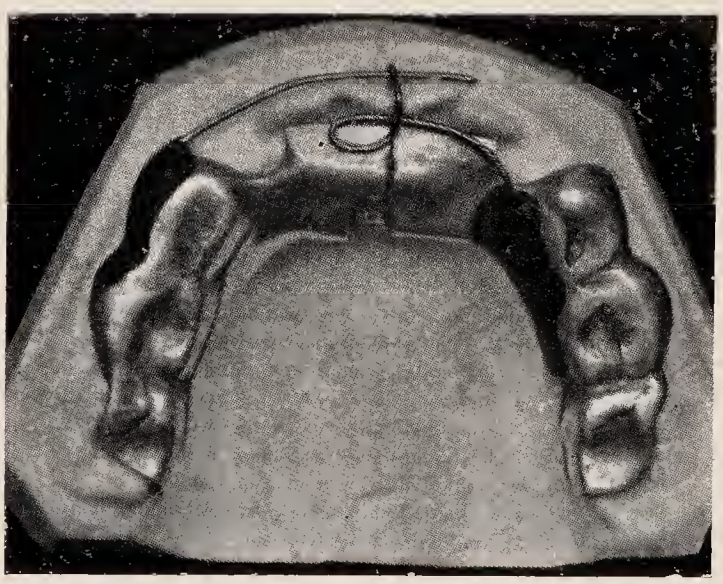


Fig. 10

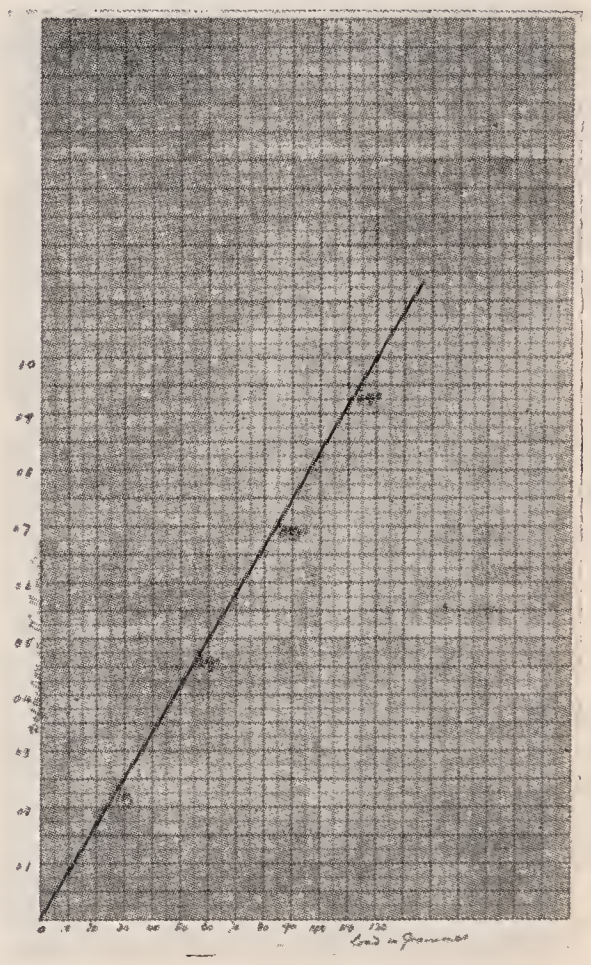


Fig. 11

that we are dealing with connective tissues, which must be constantly altering to meet new conditions existing apart from any orthodontic treatment. Further, mechanical interference is always undertaken at an age when the body as a whole is most responsive to corrective stimuli.

It will not be out of place now to make some mention of the different types of appliances commonly used for producing torsional force, and in doing so I shall not dogmatise on the advantages of any one type, for choice of apparatus will always depend upon the individual, and I have no doubt but that every known method has its advocates, who are able to get satisfactory results. I propose, however, to mention qualities which I consider the ideal apparatus should possess, and then to describe shortly my impressions of a few of those methods in common use. Later, perhaps, some of you will be good enough to polish up my views. My ideal apparatus would be comfortable, hygienic, easy to construct and adjust; the force exerted by it would be gentle and yet continuous; there would be no possibility of applying too great a force in adjustment —a very important provision, for we are sometimes in a hurry and inclined to overdo things; each adjustment should be definitely measurable in some way.

Now for my impressions of some common types of apparatus. I have never used the Angle ribbon arch with pin and tube device. At one time I intended making a trial, but I was disinclined to do so by the remarks of a very skilled and experienced orthodontist, who told me that he had discarded using it because he found it made the teeth loose, and that is rather what I should expect to happen, for I have thought that the pull directed against the tooth might be of too rigid a nature. However, I have had no experience in using the arch, whilst others with whom it is popular hold it in high esteem. The contracting force of a grass line ligature moistened with saliva is often used. Everyone is familiar with the method of attachment. I have used this method frequently, but have not been completely satisfied, as I have never felt capable of controlling the force directed. I have constantly used rubber pegs inserted in a vulcanite plate, and I think they are less popular than they deserve to be. They are certainly clumsy and the bite has to be gagged, which, however, sometimes appears to be an advantage. In their use it is essential that the plate should be countersunk and the rubber cut off as short as possible. Under no circumstances should they be allowed to project, when the plate is first inserted, or the patient in biting the plate home will exert enormous pressure on the teeth. My experience is that used carefully this method can be depended on to rotate teeth successfully and without making them at all loose during the procedure.

I mentioned my views on what I considered the ideal apparatus to my friend Mr. Brown, and asked him what he could do about it, and I have to show you some slides of the apparatus he very kindly constructed for me. As you will see, the principle used is that of the finger spring. Personally I like them very much indeed, but of course they may not appeal to others.

No. 1.—This shows the essential parts of one type of apparatus assembled on a model. They are eventually to be incorporated in a vulcanite plate, and such a plate will be handed round. The

pressure is exerted by a finger spring which is, however, fixed at both ends. The spring is constructed out of Angle ribbon wire and the force exerted is regulated by a turn of the nut. The force exerted by the screw, which is extremely slight, is made more gradual by the spring of the bow. You may notice that there is a ball and socket joint at the other extremity of the wire ; this is thought to be an advantage in making the apparatus as flexible as possible. I am not certain if it is essential, but I consider that there is considerable scope for the use of the ball and socket joint in orthodontia.

No. 2.—This is another type, and is more suitable where expansion is to be combined with torsion. It consists of two springs which are reciprocal in action. If anyone is interested he will get the best impression of the mechanical action by taking the case on and off the model.

No. 3.—This is similar in type to No. 2, and shows the use of the same type of spring under different conditions.

At the last meeting of this Society Mr. McKaig pointed out how important it was that we should know what force was actually exerted by springs, and explained some original work he had done on this subject, so I thought it would be as well to get the force exerted by one of the springs I have shown accurately measured. As you can see from the graph, a deflection of 1 millimetre exerts a pressure of 120 grammes, equal approximately to 4 ozs. Variations of the force exerted will, as Mr. McKaig pointed out, depend on the length of the spring and the thickness of the wire. These are both constants. The force exerted will vary inversely as the cube of the length, so that if you halve the length of the spring you exert eight times as much force, or if you double the length of the spring the force will be one-eighth as much. Again, the force directed varies directly to the fourth power as to the increase in thickness, so that if you double the thickness of the wire the force will be sixteen times as much. The influence of length and thickness is indeed a revelation to me, and I am very much indebted to Mr. McKaig for starting such a fascinating study.

The question of retention is beyond the scope of this paper, and indeed it would seem that as we improve in our management of tooth movement the importance of retention will loom less in the foreground, for ideal movement should not proceed faster than the reaction of the tissues. In the absence of factors influencing a reversion to the original irregularity, retention should be almost a negligible quantity.

I have no more to say except to express my indebtedness to those whose knowledge and opinions I have so freely made use of. I have to thank Mr. Brown for making the apparatus, and also Mr. Batson of the National Physical Laboratory for preparing the graphs and for giving me such valuable information as to the formulæ for the variations. And to thank you, sir, and also the members, for their courteous attention.

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Noyes, " Dental Histology and Embryology."
Sir Arthur Keith, " Menders of the Maimed."
" Tissue Changes, Particularly those of Bone, Incident to Tooth Movement," *American Ortho.*, No. 2, Vol. III ; No. 3, Vol. III.

Sir Wm. McEwen, "Growth of Bone."
Allison and Brookes, "Bone Atrophy."
Howard Mummery, "Diseases of Peridental Tissues due to Infection in their Relation to Toxæmia."

Discussion.

Mr. H. Chapman said he would not like to comment on one part more than another, because the whole subject had been very lucidly laid before the meeting. It was strange that the author had referred to the predisposition to pyorrhœa, because he had been told only a few weeks ago by a colleague that he had seen a boy who had undoubtedly pyorrhœa resulting from the placing of bands on his molars. That, of course, was a possibility; but it did not seem to him to mean anything more to orthodontists than a warning, because everyone knew perfectly well that bands could be put on molars, and could be moved considerably without any sign of detriment. He (the speaker) had also happened to see a case recently where there had been an attempt made to turn a tooth into a position where there was absolutely insufficient room for it. No attempt, as far as he could gather, had been made to make room before the tooth was turned; there was simply an effort made to turn it, and the attempt was desisted in because the tooth got very loose, much as Mr. Mayer had described. With regard to treatment, he believed that it was most important to rotate teeth very early, and it had been in his mind for some time that if one rotated teeth before the root was completely formed they would remain in their new positions without retention, as Mr. Mayer had said. It seemed to him that that could be accounted for by the fact that if the apex was formed after the tooth was in its new position, those tangential fibres to which Mr. Mayer had referred, and the tissues to which they were attached, would be formed in the position which they were ultimately to occupy, and therefore it seemed to him there was no reason why that tooth should revert to its former position. He had had numerous cases where he had rotated teeth successfully, even beyond his aspirations, by doing it early; whereas where he had rotated them after the tooth was fully formed he had had a certain amount of disappointment. He had made that remark to Mr. McKeag after the last meeting, and he told him he had a case where he had rotated a tooth in a patient aged about 18, and that the tooth remained in its position perfectly well; so that would seem to contradict what he (the speaker) had said to some extent. On the other hand, in the same case Mr. McKeag was placing two centrals in alignment—one was in front of the other—and those teeth did not remain; they reverted, while the rotated tooth, which was a lateral, remained. The ideal way of moving teeth, as Mr. Mayer had said, was with the very gentlest force, and his own method at the present moment was to use auxiliary springs, not quite in the manner which had been shown, but in a somewhat similar way.

(Method shown on blackboard.)

He, like the author, had tried the method of rotating teeth with what he might call rigidly fixed points, e.g. with a plate on one side and a rigid wire on the other, hoping that perhaps the eruption would do what was required, but he had not found that that was so successful.

Mr. G. F. Cale-Matthews said that he thought the paper was a very valuable contribution, and when printed it would be very useful in pointing out to very many, particularly students, upon whom all teachers were anxious to impress the care that they should take of the periodontal membrane. It was one of the most difficult things in teaching to make a student appreciate the delicacy of that membrane, and its importance. Mr. Chapman had voiced what he would have said in criticism of the appliances. He considered that those very delicate finger springs had an illimitable capacity of use; their use was only limited by the ingenuity of the practitioner. The type of appliance which he was using to-day almost exclusively, eliminated

any anxiety with regard to gingivitis or subsequent pyorrhœa. He thought those who were using them might feel very much happier than they did with any closed-up appliance of which a plate formed a part.

Mr. J. H. Badcock said that the point which Mr. Mayer had particularly stressed: early movement and gentle movement, he regarded as of first importance. In rotating a tooth it was necessary to be careful not only to make sure that there was room to move it into, but also that there had been some change in the forces acting upon the tooth. If a tooth was rotated, it was because of some forces acting upon it to rotate it; and if one turned it into another position and did not alter the forces acting upon it, it was bound to return to its old position. That was a point which was often not appreciated. He would like to ask members if they had noticed any particular tendency to rotation of bicuspid teeth after the use of expansion plates. He could not help thinking that when an expansion plate had been used while the temporary teeth were in position, there was a considerable liability for the permanent teeth to come through rotated; certainly they did so in a large number of cases. It seemed to him that this might possibly be explained as follows. The bicuspid lay between the roots of the temporary molar, and was carried outwards with it. If the force exerted by the enveloping root did not act exactly on the middle of the bicuspid it would rotate it to one side or the other. With regard to the methods to be used in rotation, he was very fond of the screw, and on the whole preferred it to the spring. It seemed to him that it did everything that the spring did, and perhaps had certain advantages which the spring had not. He himself used two methods of rotation: one was by ligature which Mr. Mayer had mentioned, and the other by means of the screw. In using the screw to rotate a lateral incisor, for example, he used a plate with a wire going round the front of the tooth, which impinged on the outstanding corner of the lateral. Then he had a small screw mounted in the plate, which impinged on the instanding corner, and the head of the screw touched the tooth. By unscrewing the screw very slightly at certain intervals—he used a quarter of a turn every other day—one applied a very gentle force. One advantage of the method was that nothing could go wrong. Supposing the patient got ill, the screw would after it had pressed a certain distance have no further action; whereas a spring, unless its action were limited, might go on acting to a disastrous extent. Furthermore, the screw was not liable to get out of order, and another point in its favour was that it did not need the attention of the dentist, or at any rate very seldom. One knew the amount one wished to push the tooth forward, and one could calculate by the number of threads on the screw exactly how long that screw would have to be turned in order to achieve the result, and that, he thought, was a very considerable advantage. He always liked to arrange an apparatus which needed as little attention as possible on the part of the dentist. There was one further point about the screw, namely, that nothing could hurt it, while delicate springs were liable to damage.

Mr. W. W. James said that in discussing the changes that occur in the bone and in the periodontal membrane, and also in the cementum, one had to remember that it was a plastic tissue, probably undergoing change. The life history of those cells was not known, nor how long the fibre lasts, and he thought the conception of Mr. Mayer, and perhaps also of the investigators to whom he had referred, was a little too mechanical. It was connective tissue, and if one threw a stress upon a connective tissue the torsion would be upon the more taut fibres, and he took it the bone itself was also of very elastic substance. He did not know whether Mr. Mayer's paper was supposed to be limited merely to torsion, but the movements of a tooth with an appliance did not only take place in the socket. It was true the socket was a very important factor, but those models which had been shown by Mr. Pitts and by

himself showed clearly how the bone itself could undergo a very great change in position. Mr. Mayer was to be congratulated upon his paper.

Mr. A. T. Pitts said that notwithstanding Oppenheim's experiments and those of a good many others, he still found it extremely difficult to envisage the changes that occur in the surrounding tissues in tooth movement, and he quite agreed with Mr. James that there was perhaps a tendency to put them a little too mechanically. The word " plastic " in connection with bones was an unfortunate word, because it carried with it the impression that a bone was something that could be pushed in, like putty. Obviously bone could only be altered in shape by absorption and deposition. What changes occurred when the periodontal membrane of a tooth was rotated ? He took it that it could not be that the fibres of the membrane took a new grip of the cementum. Mr. Mayer had put it rather in that way, but he did not think he meant that it was like the tendrils of a Virginia creeper holding to a wall. The cementum might be regarded as a part of the periodontal membrane which had become calcified, which explains how the principal fibres of the membrane extended into the cementum. One must postulate either an actual stretching of those fibres—again a not very adequate expression—or that if those fibres atrophied, and the fibroblasts lay down fresh fibres, the re-attachment of those fibres to the cementum could only be by new cementum being laid down on the old cementum. One of the sections of Noyes shown by Mr. Mayer would seem to indicate that perhaps that was the way in which it happened. It was difficult to obtain evidence. The radiogram did not show any distinction between cement and dentine ; and it would really need, for proof, that teeth should be taken out with their bone around them, and sections taken, which would be a difficult thing to do. With regard to the question of how far movement of teeth caused pyorrhœa, there was an impression gathering in some quarters that it might. Of course everyone was agreed that when bands were put too low under the gum, and set up ulcerative conditions, it might do so ; but he gathered that some people were suggesting something more than that—that as a result of a chronic irritation, or chronic stimuli over a period, there might be changes in the periodontal membrane apart from ulceration which led to pyorrhœa. If one accepted the view that pyorrhœa might start internally, not as an extension from the gum, then he thought it became a feasible thing. He did not know of any evidence, but the matter was certainly worth investigation. If it turned out to be so it would be a very serious matter indeed, but he did not think one ought to conclude that it was so without very strong evidence. He would suggest that one should not only think of the possibilities of orthodontic appliances causing pyorrhœa only from the point of view of the wounding of the membrane and of the bacterial invasion that followed, but the conceivable possibility that there might be some internal atrophy of the periodontal membrane. He had been interested in what Mr. Badcock had to say about screws. He wondered if Mr. Badcock had had the experience with those screws that he had sometimes had with the expansion screw plate, namely, that after a time the screw worked a little loose. He found that sometimes the patients, in their laudable efforts to clean the plate, rubbed the screw the wrong way, and like Penelope when she by night undid the web that she wove all day, undid all the work that had been carried out in the preceding days.

Mr. J. H. Badcock said he had found the difficulty to which Mr. Pitts referred. It all depended on how tightly the screw fitted the vulcanite. If one shaped the vulcanite in such a way that the screw fitted tightly, the difficulty was not to keep it sufficiently tight but to keep it sufficiently loose so as to be able to turn it easily, and one had to hit off the happy mean between the two. If one made it too loose it would, as Mr. Pitts had said, not do its work. If, on the

contrary, one made it too tight it was equally useless, because the patient could not turn it, and with the little screwdriver he gave them they would screw the head off the screw instead of adjusting it. If it was properly adjusted it worked satisfactorily. Of course, the same thing did happen with the expansion screw until recently, when Messrs. Ash introduced into its mechanism a spring split washer which prevented the screw from slipping back. He had tried many devices, none of which was successful, and then Messrs. Ash had suggested that, and he thought it had absolutely cured that extremely pernicious tendency which the screw had to come loose.

Mr. PITTS said that when a screw had worked loose he had frequently, particularly with an expansion plate, put a little piece of a spiral gold spring on for the purpose of maintaining it in position. He said that the Korbitz method, or rather a variation of it, which Mr. Samuel had brought to his notice, had proved the most successful method.

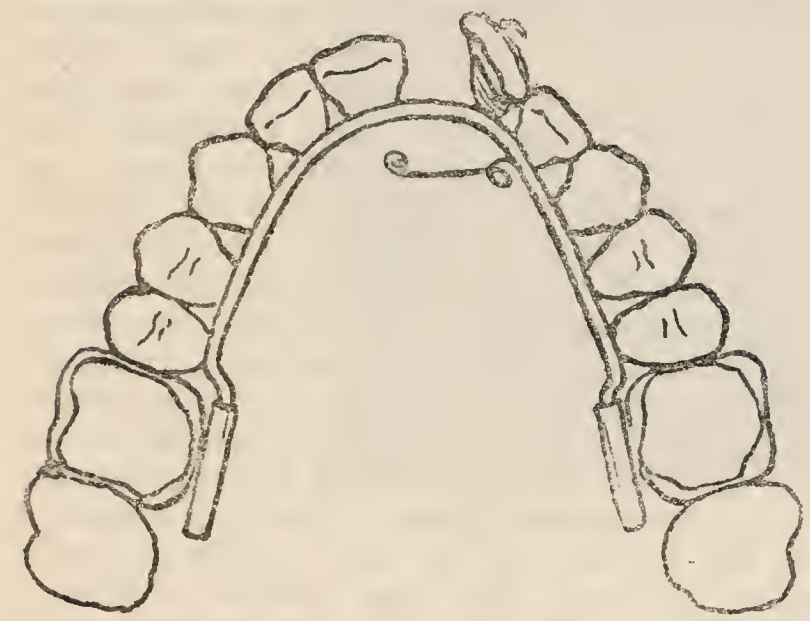
Mr. BERTRAM SAMUEL produced a model showing a modification of the Korbitz method of rotating teeth. He claimed no originality for the device. In cases where one had a single tooth to rotate, and provided the space was present for the rotation, it had proved extremely useful. It was quickly made; one could make the whole thing at the chairside of the patient in approximately half an hour at the outside. The model shown was made that evening in about a quarter of an hour. He presented it because he gathered that many people did not make use of it. Assuming one had a particular tooth to rotate, one first banded the tooth, then soldered vertically on the banded tooth a small piece of vertical tubing. On the back of the band, on the lingual aspect, a small hook was soldered. Then into the vertical tube a piece of wire was bent, which fitted exactly into the wire fitting into the tube. The two were fitted together, and then one had a hinged joint; and if one dropped one end of the bar through the tube, then the bar of one wire lay along *there* (indicating). Then one fixed a point (indicating), stretched a piece of elastic from the point round the tooth to another point (indicating), and the action was perfectly simple, always assuming that there was room for the tooth to come into place.

Mr. PACKHAM said Mr. Pitts had raised an interesting question when he wondered whether change might occur in the periodontal membrane quite apart from infection from the outside. There did not seem to be much doubt that it could, as it was known that changes in ligaments did occur, as in gout, for instance, and other rheumatic conditions; so it was quite conceivable to him that changes could occur in the periodontal membrane in a similar manner. There was another small point about which he would like to ask Mr. Mayer. He had understood Mr. Mayer to say that bone was apt to undergo atrophic change if the tooth was fixed and stationary. That seemed to him very likely, and occurred, he thought, when clasps were fitted tightly to teeth for purposes of retention of the denture. That occurred quite readily, and as everyone knew under these circumstances teeth did go to the wall quickly.

Mr. STEADMAN agreed with what Mr. Packham had just said—that there was no question but that periodontal trouble first started in the actual membrane without any infection from the gum margin necessarily. He felt sure that in cases which had been moved fast by orthodontic methods he had seen that actually happen, because that was why he thought the teeth not only got loose, but they would keep loose, and the membrane would become septic very soon after the changes had been made.

The PRESIDENT said there seemed to be a certain amount of doubt as to the changes that occurred in bone. Jansen claimed that bone was not re-formed by traction, that it was only re-formed from pressure. But as far as he knew, no practical evidence had been brought forward except that which had been brought forward by Oppenheim, and

until his experiments were experimentally proved or disproved he thought they had to be accepted. The last experiment that he did was to show the changes that occurred in bone during retention, and they conformed almost identically with the other experiments which Mr. Mayer had shown, i.e. that the bone re-formed parallel to the greatest force, namely, the force of mastication, and that the laminæ of the bone were all parallel to the long axis of the tooth. Everyone seemed to agree that with teeth which had been rotated they returned a certain amount towards their former position, except after prolonged retension, and he had often thought that it was possibly due to the dental ligament. One did not get re-forming of the dental ligament as fast as one got changes in bone, and possibly the dental ligament had been stretched to a certain extent, if he might use that word, and it pulled the tooth back that small distance. His objection to screw pressure was that it was not continuous, that it was an intermittent pressure, and he thought one obtained probably a more even pull from a spring, and less looseness. There was one particular type of movement which used to cause him a great deal of worry, i.e. where a central incisor was rotated with the mesio-labial angle mesial.

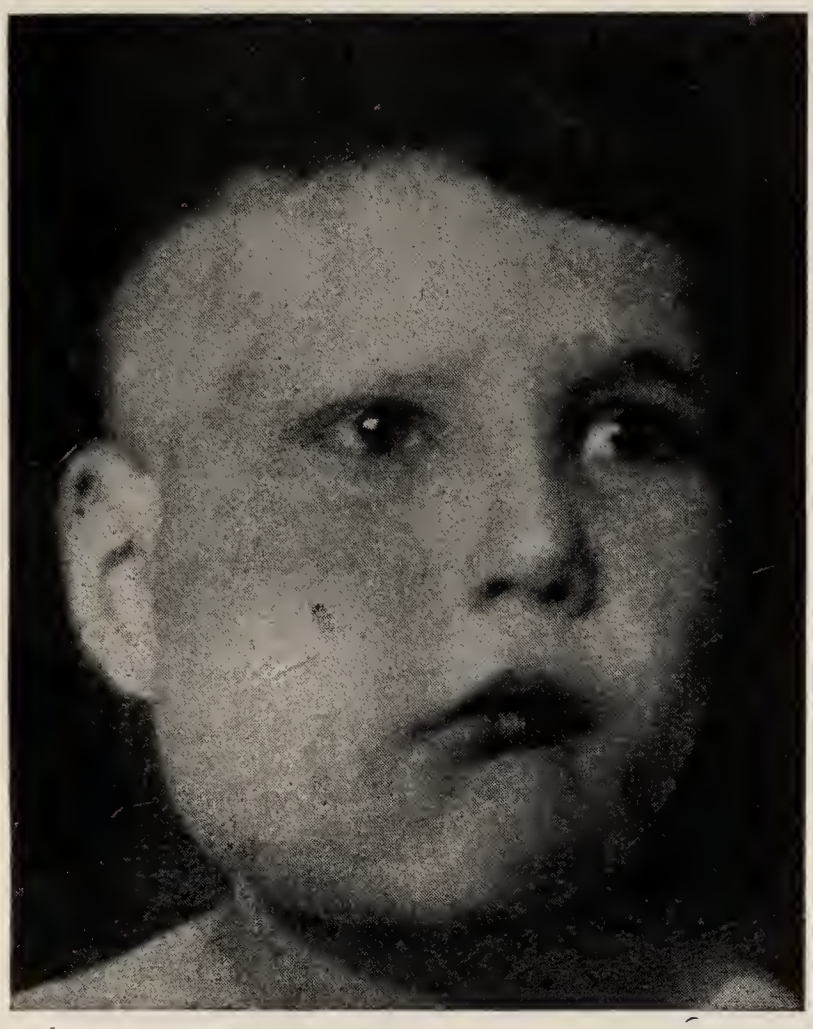


It was very difficult to get pressure on the labial surface of the tooth, and the way he had succeeded in doing so fairly satisfactorily was to put on a lingual arch, make a ring for the rotated tooth with a little spur on the labial surface, and solder a finger spring on the lingual arch, and then with a ligature to tie the finger spring back to the spur on the rotated tooth, after which it worked automatically. The important thing to remember was that the hook or spur must be in the same horizontal plane as the spring and the arch. He had seen a case where it was not in the same horizontal plane, and the apex of the tooth was almost projected through the gum by getting a wrong point of leverage. He wished to thank Mr. Mayer for his most excellent paper.

Mr. Mayer (in reply) said that the spring Mr. Chapman had described was a plain finger spring, which he used on a fixed appliance. The only reason for the small auxiliary labial spring on the cases he had described was because it appeared that when one used plates instead of fixed appliances there seemed to be much more liability for the spring to get disturbed in eating, and he could not help thinking that the reinforcement avoided that difficulty to a certain extent. Mr. Badcock had mentioned the importance of making room, and the fact that bicuspids were found rotated when expansion plates had been used. He believed that some time ago there had been a casual communication to the Society of a bicuspid which was actually completely rotated, and he thought Mr. George Northcroft had said there must have been some interference with the tooth germ. He personally did not think they were often very excessively rotated, but perhaps he had not looked out for the trouble as carefully as Mr. Badcock had. Mr. Badcock had also said that he thought the screw was very much better than the spring. He felt about the screw used alone was that it had the force rather of a wedge. If a plate were put in where the screw had been turned so far, unless there was some spring attached to it, as in the form of plate shown, it seemed to him that the screw must

act rather in the form of a wedge, and he thought that some of that wedge-like action could be taken off by a bow of some sort. Mr. James and Mr. Pitts had both said that his conception was too mechanical. He had had misgivings about that part of his paper. It would be realised that he knew very little about it. It was a subject of which ordinary people could only get their knowledge from text-books, and he was quite ready to agree that his conception was too mechanical, but he had felt it was the best way he could put it. The expression of the periodontal membrane taking a fresh grip of the cement was perhaps a little too much of a good thing. He was afraid he was not competent to discuss the question of epithelial débris and its influence.

With regard to Mr. Samuel's modification of the Korbitz method, he thought it was very ingenious. He might, perhaps, offer a little criticism by saying that his experience was that if one used an elastic, one had got to make considerable room somehow or other between the two teeth between which the elastic went, and he was inclined to think that that was sometimes undesirable. He did not think there could be any doubt that changes in the periodontal membrane took place from outside, as Mr. Packham and Mr. Steadman had mentioned, and he had absolutely no doubt at all that many of the dentures one made where bands were used, and where the tooth which was gripped was actually fixed, caused atrophic changes to take place, and that the tooth was in that case very soon finished. The President had mentioned the work Jansen had done on the changes in bone. As the President had said, he disagreed almost entirely with the correctness of Wolff's theory. The subject was a difficult one, but he agreed with the President. He did not see how one could ignore the experiments of Oppenheim. The President seemed to think that the screw was not always perfectly satisfactory, and that it was best, perhaps, to use some spring with it. The device shown on the blackboard he would take much notice of, and he would certainly use it at the very first opportunity. The President had mentioned the importance of keeping the spring in the same horizontal plane. That, as a matter of fact, was a very easy thing not to do, and it was a very common thing when one used traction to have the two points not in a horizontal plane, and one got either a depressing force or an elevating force, which was very disastrous, and a thing which one ought to be most careful to avoid.



Illustrating Mr. W. Warwick James's case.

DISTORTION OF THE MAXILLARY ARCH.

Illustrating Mr. W. Warwick James's case.

DEFORMITY OF THE MAXILLA CAUSED BY AN ANGEIOMA.

Fig. 1. Model of maxilla showing lateral compression of arch. The right side has been pushed forwards as well as laterally.

Fig. 2. Model of mandible of same case. The arch is not compressed laterally, but the right side has been pushed forwards.

Illustrating Mr. A. T. Pitts' Case.

CASE OF CONGENITAL ABSENCE OF THE DECIDUOUS AND PERMANENT LOWER CENTRAL INCISORS IN FOUR MEMBERS OF A FAMILY.

FIG. 1.
HARRY A.
10 years 8 months.

FIG. 2.
SIDNEY A.
8 years 8 months.

FIG. 3.
ERIC A.
1 year 4 months.

HARRY A. SIDNEY A. ERIC A.

Diagrams of lower incisor region, showing absence of permanent central incisors but presence of permanent laterals in HARRY A. and SIDNEY A. Tooth germs of permanent laterals of ERIC A. visible.
Illustrating Mr. A. T. PITTS' case.

An Ordinary Meeting of the Society was held at 11, Chandos Street, Cavendish Square, W.1, on Monday, November 3rd, 1924, at 8 p.m., Mr. E. Sheldon Friel (President) occupying the chair.

The following new members were elected: Miss Rosamond Caseley, L.D.S.R.C.S.Eng., 42, Alwyne Road, Wimbledon, S.W.19; Mr. George C. Robb, B.E., D.Dent.Sc., 22, Hoghton Street, Southport, Lancs; Miss Kathleen Corisand Smythe, L.D.S.R.C.S.Eng., 32, Dartmouth Road, Forest Hill, S.E.23.

Casual Communications were given by Mr. W. Warwick James and Mr. A. T. Pitts.

DISTORTION OF THE MAXILLARY ARCH.

Mr. W. W. James described a case due to pressure from a sarcoma involving the cheek of a child, and with a history of four months' duration. The boy was aged about 6 years, and was seen at the Middlesex Hospital with a swelling in the right cheek, which was connected with the mandible. A portion of tissue removed for examination proved the swelling to be due to a sarcoma. The tumour did not involve the maxilla.

On the left side the first permanent molar was in position in the mandible, and was just showing in the maxilla. On the other side they had not developed, but an X-ray film shows that of the mandible to be in an extraordinarily low position, whilst one cusp could be seen just near the floor of the mouth. The skiagrams also showed rarefaction of the mandible in the ascending ramus and at the base of the coronoid process.

Mr. James produced models showing the deformity of the maxillary arch which was flattened from behind the canine and involved the bone almost to the vault of the palate. The patient complained that the cheek was sometimes bitten upon. A similar deformity occurred also in the mandible, but as the growth involved the bone the change is perhaps of less significance. To us the chief interest in the case is due to the fact that the maxilla was undoubtedly distorted by the pressure of the growth in the cheek upon the maxillary arch. Changes had been noticed by the mother before the taking of the models. With regard to previous history, the child had some discharge from the nose and the right lip was swollen at birth, but the swelling disappeared and no further trouble supervened.

The treatment comprised removal of glands in the neck, but they did not show any signs of growth. Radium was inserted, and the tumour diminished in size very considerably and almost disappeared. It recurred, and radium was again introduced. That was two years ago, and Mr. James had seen the child about a year ago, and then the growth was not any larger than when he had first seen the boy. He had not been able to trace the case at Middlesex Hospital since about six months ago, up to which time the boy was attending regularly. Nothing was known of him since, and Mr. James hardly liked to write to his parents to know if he was still alive, as the case was almost certain to be fatal.

DEFORMITY OF THE MAXILLA CAUSED BY AN ANGEIOMA.

By A. T. Pitts, D.S.O., M.R.C.S., L.D.S.

This is a case of extreme compression of the maxilla caused by the pressure of an angeioma of the right cheek in a boy of 17.

The patient was admitted to the Middlesex Hospital under the care of Mr. Eric Pearce Gould, to whom I am indebted for permission to record this case. The boy had a large angeioma of the right cheek which projected externally and also into the mouth. The external part was about the size of a large orange. The tumour projected into the mouth more than half-way across to the opposite cheek, passing between the upper and lower teeth so that he was unable to close the mouth, which was kept widely open. The total size of the tumour must have been very considerable, for the segment lying between the most prominent point externally and the most internally was about $5\frac{3}{4}$ inches. The whole tumour must have measured nearly 11 inches in circumference. The tumour was soft and compressible and had been growing for three years. It had increased rapidly during the last two years. The upper jaw shows an extreme degree of lateral compression so that the molars on each side are nearly in contact. The lower jaw, on the other hand, is of normal width. Mastication was quite impossible, for the mass projecting between the upper and lower teeth acted as an effectual gag. The patient told me that up to two years ago the palate was normal and only commenced to become narrow about two years ago, when the tumour commenced to increase rapidly. The teeth were not loose, though there was some caries and the mouth was far from clean. It was a somewhat difficult matter to take an impression, and I used the handle of a tray. The impressions are not good, but they show fairly accurately the lateral compression of the maxilla. I think it quite probable that the patient always had a narrow upper arch, for the facies suggested the adenoid type. At the same time the disfigurement caused by the tumour was so great that it was difficult to be certain. But even allowing for the possibility that the arch was always of the contracted type, the case still remains one of great interest.

A CASE OF CONGENITAL ABSENCE OF THE DECIDUOUS AND PERMANENT LOWER CENTRAL INCISORS IN FOUR MEMBERS OF A FAMILY.

By A. T. Pitts, D.S.O., M.R.C.S., L.D.S.

Although absence of the upper second incisors is not uncommon, absence of lower incisors is comparatively rare. This case has an additional interest in that the condition was present in four members of one family. Harry A., aged 10 years 8 months; and his brother, Sidney A., aged 8 years 8 months, were first seen by me at the Hospital for Sick Children four years ago. I noted then that there were only two lower incisors present in both cases, and that they were widely separated. Furthermore that in the case of the younger child, Sidney, the incisors present were somewhat peg-shaped. Inquiries of the mother were made, and she assured me that both children had never had more than two incisors and that neither child had lost any teeth in the lower incisor region. She also informed me that a twin brother of the older child, Harry, now dead, had had a similar condition. I was not able to get skiagrams taken then, but on clinical grounds it seemed probable

that there was an absence of the lower deciduous central incisors in each child, as well as a similar condition in another member of the family now dead, probably an absence of the permanent central incisors. I saw both children again this year. The condition was exactly the same. Eruption had gone on normally with regard to the rest of the teeth, but these widely separated incisors were still firm. The mother also brought another boy, Eric, aged 14 months, the remaining member of the family. He had the four upper incisors present ; in the lower jaw there were two small peg-shaped teeth widely separated, like the condition in his brothers. I had dental films taken of each child. These showed that there were permanent successors to the lower lateral incisors in the two oldest brothers, but there was no sign of any lower central incisors, either temporary or permanent. In the baby no permanent tooth germs could be seen, but at so early an age the small amount of calcified tissue of the permanent incisors is very likely to be masked by the roots of the deciduous teeth. There was, however, no sign of any unerupted incisors which might correspond with the missing central deciduous incisors. I think the evidence is complete that in all four children there was an absence of the central lower incisors of both the deciduous and permanent dentitions. In the case of two, Harry and Sidney, there is both clinical and radiographic evidence. In the case of the baby, Eric, radiographic evidence is not so satisfactory, but yet sufficiently convincing. In the case of the fourth child, now dead, the evidence rests on the testimony of the mother. She was a very intelligent woman, and I think her statement can be relied on, especially as the wide separation of the lower incisors was conspicuous and not easily overlooked. There was no history of any similar condition either in the mother or father, or in any of their relations. The children were well grown and healthy and otherwise normal.

Discussion.

The President asked, in the case of the congenital absence of deciduous and permanent centrals, whether there was any record of the absence of teeth in the parents, or whether it was only in the children. He, himself, had seen one case where the lower deciduous centrals were absent, but the permanent centrals were present.

Mr. Pitts replied that he ought to have said that both the father and mother had lost their teeth some considerable time previously, so he had been unable to get evidence as to their condition in that respect.

Mr. H. Chapman said he happened to have a patient at the present time with one lower permanent central incisor missing. He was not sure whether the boy had the deciduous ones or not. He wished to ask Mr. Pitts whether he had formed an opinion whether those things had a hereditary basis. It seemed as if they were hereditary, and it also seemed as if certain types of malocclusions were hereditary also, because lately he had come across quite a number of patients, brothers and sisters, with strikingly similar anomalies, and it did not seem that that could be entirely due to environment and other causes, but must be due to at least partially something even more fundamental.

Mr. Pitts said that with regard to the first specimen he had measured from the most prominent point externally round to the most prominent point of the tumour internally, and the measurement was nearly six inches, so that if the tumour could have been dissected out he would imagine it must have been at least twelve inches in circumference.

With regard to Mr. Chapman's question, his own feeling was that undoubtedly there was a hereditary basis in many of those cases of absence of teeth, and he quite agreed that there was often a hereditary basis in many cases of malocclusion ; in fact, he had seen several cases. In the present case he did not know whether there was a hereditary history, since he could find no record of the parents or any of their brothers or sisters possessing it. He did have some time ago a case of a mother with an absence of the upper lateral incisors and two daughters, both of whom had absence of the upper lateral incisors, while one of them had in addition an absence of a lower lateral incisor. In this case the evidence of heredity was quite well marked.

Annual General Meeting.

The Annual General Meeting of the British Society for the Study of Orthodontics was held at 11, Chandos Street, Cavendish Square, W., on Monday, December 1st, 1924, the President, Mr. E. Sheldon Friel, in the chair.

The minutes of the previous meeting were read and confirmed.

The following candidates approved by the Council were elected members of the Society :—

H. Dagger, L.D.S.Eng., B.D.S.Liv., D.D.S.Penn., St. Paul's Road, Newton Abbot.

F. J. Downing, L.D.S., R.C.S.Eng., 165, London Road, Leicester.

L. M. Markham, M.B., B.S. (Univ. Durham), L.D.S.Eng., 1, Victoria Square, Newcastle-on-Tyne.

The President read the names of the Officers and Councillors nominated by the Council, and in the absence of any further nominations, declared them elected as follows :—

President	Mr. Harold Chapman
Immediate Past President ..	Mr. E. Sheldon Friel
Vice-Presidents	Mr. G. F. Cale-Matthews
	Mr. H. C. Highton
	Mr. B. Maxwell Stephens
Secretary	Mr. A. L. Packham
Treasurer	Mr. William Ovey
Curator	Mr. B. Maxwell Stephens
Librarian	Mr. Bertram Samuel
Editor	Mr. Carl Schelling
Councillors	Mr. H. T. A. McKeag
	Mr. A. T. Pitts
	Mr. G. Northcroft

A paper was given by Miss V. H. George, "A Comparative Study of the Jaws and Occlusion of Maoris and British-born in New Zealand." (See page 70.)

The President's Valedictory Address.

Mr. Sheldon Friel, on vacating the chair of the Society, said : It is with mixed feelings that I end my year of office as your President. It has been such a great pleasure owing to the loyal support of your Council and Officers and the kindness of the members that one does regret that the year passes so quickly. On the other hand, to have the honour of welcoming your new President makes up for any regrets that one might have had. Considerable advance has been made during the year in our knowledge of orthodontics. In every paper read before the Society this session the aim in view has been to emphasise the

importance of a knowledge of the fundamentals of orthodontics, whether those fundamentals concern the development of the normal organism or are concerned with the treatment of the mal-development of the individual. The Dental Board lectures have added considerable information concerning the growth of the jaws, and in addition have stated the problems that face the workers in orthodontics. They have shown how little we really know of the manner of the growth of the jaws. Your Council has kept in being the Committee on Education, as I think they realised that the higher the standard of orthodontics education in the dental schools, the greater would be the scientific interest in this subject. A chart for the use of dental schools has been drawn up by the Committee, and will be submitted to your Council for approval shortly. I think few of us realise fully how much the success of the Society is due to the untiring efforts of its officers, especially the Hon. Secretary, and I personally wish to thank them most heartily. Mr. Chapman, an original member of the Society, has acted as Hon. Secretary for the past fourteen years, and he must feel proud when he considers the results of his efforts. We owe him a great debt of gratitude, and I can only say that I feel it a privilege and honour to induct him as your new President. I wish him every success in his year of office.

Induction of President elect.

Mr. Harold Chapman, in taking the chair, said that words failed him to thank the Society adequately for the honour done him. He never remembered having moved so short a distance and gone so far (from the Secretary's to the President's chair). He thanked them all most sincerely.

Mr. A. T. Pitts said that Mr. Chapman had been Secretary to the Society for fourteen years, an unusual length of time for anyone to have held such a post, particularly a post which was not a sinecure. During that time he had seen orthodontics grow to an enormous extent. He would like to propose a hearty vote of thanks to Mr. Chapman for his work for the Society, and to assure him that not only this Society but the science of Orthodontics in general was deeply indebted to him.

The vote of thanks was accorded by acclamation.

Mr. Chapman, after acknowledging the compliment, said that a vote of thanks was more than due to the late President, Mr. Friel, for the very able way in which he had conducted the meetings and for the ardour which he had displayed generally in the work of the Society. He did not think anybody else in the room except the outgoing President could realise what it meant to come over from Dublin seven times in the year to preside over the meetings.

This vote of thanks also was carried by acclamation.

Mr. Friel expressed his acknowledgment.

Mr. Pitts proposed, and Mr. Samuel seconded the election of Mr. Strickland as one of the Auditors.

Mrs. Lindsay proposed and Dr. Doubleday seconded Mr. Bulleid as the other Auditor. Mr. Strickland and Mr. Bulleid were elected unanimously.

The Hon. Treasurer (Mr. W. Ovey) read the Treasurer's Report as follows :

I beg to report that the total income of the Society for the past year amounted to £180 2*s.* 2*d.*, of which £5 16*s.* 2*d.* was derived from interest on investments and the remainder from members' subscriptions. Against this there has been an expenditure for the regular working of the Society of £145 10*s.* 4*d.*; a donation of twenty guineas has been voted by the Council towards the Japanese Dentists' Relief Fund, and the sum of £25 placed on deposit towards the Prize Fund ; making a total disbursement of £191 10*s.* 4*d.* So that, strictly speaking, there is a deficit of £11 8*s.* 2*d.* on the year's working.

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

STATEMENT OF ACCOUNTS from December 1st to November 30th, 1924.

1922-1923. £ s. d.	Assets.	1923-1924. £ s. d.
150 0 0	To Government Securities (redeemable at par)	150 0 0
22 0 6	„ Cash at Bank	49 18 0
1 19 10	„ Cash in hand	1 5 11½
5 18 4	„ Interest on Securities	5 16 2
51 19 10	„ Sale of Exchequer Bonds	—
161 13 0	„ Members' Subscriptions	174 6 0
£393 11 6		£381 6 1½

1922-1923. £ s. d.	Expenditure.	1923-1924. £ s. d.
15 15 0	By Rent	15 15 0
6 6 0	„ Hire of Epidiascope	5 5 0
24 1 11	„ Printing	31 2 3
44 0 0	„ Transactions	29 14 6
17 17 0	„ Reporting	22 11 6
—	„ Typing	1 15 0
9 14 6	„ Librarian	14 9 6
6 13 10½	„ Petty Cash and Cheque Book ...	7 0 7
—	„ Fares to Patients	6 0 0
—	„ Refunded Subscriptions	2 2 0
8 15 0	„ Refreshments	9 15 0
—	„ Donation to Japanese Relief Fund ...	21 0 0
50 14 3	„ Purchase of War Loan	—
8 10 0	„ Delegates to Lyons Conference ...	—
192 7 6½		166 10 4
150 0 0	„ Securities	150 0 0
49 18 0	„ Cash at Bank	39 2 1
—	„ Cash on Deposit (Prize Fund) ...	25 0 0
1 5 11½	„ Cash in hand	0 13 8½
£393 11 6		£381 6 1½

We have examined the Books and Vouchers and find the above Statement of Accounts to be correct.

(Signed) RALPH BOUTWOOD.
A. GARROW.
Hon. Auditors.

The Society's available resources are £100 Treasury Bonds (B), £50 5 per cent. War Loan, and bank balances of £39 2*s.* 1*d.*, and £25 in current and deposit accounts respectively.

In accordance with a recommendation by the Hon. Auditors, the Society's accounts will in future be presented in the form of a Balance Sheet and Profit and Loss Account, together with lists of the contents of the library and museum.

Mr. PITTS proposed and Dr. DOUBLEDAY seconded the adoption of the report, and this was agreed to.

Mr. MAXWELL STEPHENS read the Curator's Report as follows: "Last year we had the generous gift of the museum cabinet from Mr. J. Lewin Payne, and the means therefore of satisfactorily protecting the property of the Society. This year there has been a slow accretion of specimens, notably two series presented by Mr. Watkins. As a result of the Council's appeal for models of cases of normal occlusion as near the ideal as possible, fifteen pairs have already been sent in. Measurements of these models are being made. I am pleased to report, too, that our retiring President is making a loan of fifty pairs."

Mr. STEADMAN proposed and Mr. NORTHCROFT seconded the adoption of this report, and it was agreed to.

The HON. LIBRARIAN had no report to present.

The HON. SECRETARY read his report as follows:—

The usual number of meetings have been held during the year, including the demonstration meeting which, judging from the attendance, was much appreciated.

Mr. John Humphreys, F.S.A., F.G.S., of Birmingham, is the distinguished visitor who has given us a paper this year*; other papers have been given by Mr. Friel, Mr. McKeag† and Mr. Mayer, all of which represented considerable original work. The year is also notable for the large number of short and casual communications, and is rendered more notable by the fact that this evening we are to have the first communication by a lady member.

During the year twelve members have been elected and three have resigned, leaving a membership at January 1st, 1925, of 170. The Society now has five lady members.

Your Council has dealt with the following business during 1924:—

(1) The conditions governing the award of a prize were finally decided upon, and have been published widely.

(2) A Committee of Nomenclature held several meetings, but was unable to present a report; you will have noticed that a difficulty in arriving at agreement on nomenclature has arisen in the U.S.A.

(3) The Education Committee has held several meetings; its work is not yet complete, but it may be mentioned that it is amending the previous report in minor details and preparing a chart for use in schools.

(4) The Council, acting on the report of the Investigations Committee, has asked members to send to the Society models of normal occlusion which should be as near the ideal as possible.

(5) A Committee is considering "Orthodontic Treatment in relation to the Elementary School Dental Service."

(6) This evening you will be asked to sanction an alteration to the by-laws which it is hoped will be an additional attraction to recently registered dental surgeons to join the Society early in their careers.

It has been reported to the Council that an International Orthodontic Congress will be held in New York in June, 1926, that year being the twenty-fifth anniversary of the foundation of the American Society of Orthodontics; your Society has been invited to join the Congress, and only awaits further particulars before accepting the invitation.

* Owing to a serious illness Mr. Humphreys could not provide us with the text and illustrations of the paper in time to include it in this year's report but we hope to have it for 1925 issue.

† The publication of this paper is unavoidably deferred, and will be included in the 1925 Report.

On relinquishing the Hon. Secretary's chair may I take this opportunity to thank the members, one and all, for the support and assistance which they have given so freely and thus lightened the work and made it a pleasure. I feel sure that I am voicing the sentiments of every member when I say that Mr. Packham assumes the Secretaryship with our whole-hearted support and good wishes.—HAROLD CHAPMAN.

Mr. BULLEID proposed and Mr. LEVIEN seconded the adoption of the report, and this was agreed to.

The PRESIDENT put forward the amendment of By-law XII as proposed by the Council :—

> "That the words 'Save as hereinafter provided' be placed in front of the words 'Every person elected, etc.,' and that the following words be placed after 'in advance'—'The subscription of a member joining the Society within three years of obtaining a registrable dental qualification shall be half a guinea per annum until the 31st December next occurring after the expiration of the period of three years from the date of such qualification.'"

("XII. *Save as hereinafter provided* every person elected an Ordinary or Corresponding Member shall pay an annual subscription of One Guinea in advance. *The subscription of a member joining the Society within three years of obtaining a registrable dental qualification shall be half a guinea per annum until the 31st December next occurring after the expiration of the period of three years from the date of such qualification.*")

Mrs. LINDSAY asked if the rule was to be retrospective, and the PRESIDENT said that this had been decided in the negative by the Council. The adoption of the amended by-law was then proposed by Mrs. LINDSAY, seconded by Mr. CARL SCHELLING, and agreed to.

The PRESIDENT read out the names of the following visitors, and asked them to consider themselves members of the Society for the evening : Misses Taylor, Still and Songter, and Messrs. Stein, de Palmas, Ainsworth, Campion, Howarth and Evans.

The PRESIDENT announced the future programme of the Society, including some remarks from the chair regarding a meeting on January 19th, 1925, and the proceedings then terminated.

A COMPARATIVE STUDY OF THE JAWS AND OCCLUSION OF MAORI AND OF BRITISH BORN IN NEW ZEALAND.

By VIOLET H. GEORGE, L.D.S.

WHEN I agreed to read my paper I must confess to feeling nervous in undertaking such an adventure, especially when I realised that I am probably the first woman member to address this Society.

About six months ago, during the course of my work for the Research Committee of the Dental Board at the Royal College of Surgeons, I was asked to examine a number of plaster casts sent from New Zealand. These casts, forty in all, were apparently obtained from Maori and British soldiers previous to their demobilisation in 1918-19. The models were sent to Sir A. Keith at his request, as he thought that it would be interesting to compare them with the teeth and jaws of modern Englishmen. On investigation I found two almost complete series of casts of the maxillary and mandibular arches. In the first series were those of twenty full-blooded Maoris, while the second series consisted of twenty models of British colonists born in New Zealand. In addition to

the nationality each case was marked with the man's name and age, but beyond these facts no further history is obtainable.

My first object in examining these series was to discover what, if any, were the distinguishing features of each. I began with Maori casts and found that, on the whole, the palates were well formed, usually spreading in a wide arch containing the full number of teeth. As far as could be ascertained from a plaster model the third molars had erupted into their correct positions and were not crowded nor appreciably diminished in size. Indeed, in some cases I was surprised at the size of the maxillary and mandibular teeth. As you will see by the drawings I have made (which I hope to show you later) they are indeed massive. I have not, however, found any very marked signs of attrition.

On investigating the occlusion I was interested to see that normal occlusion was apparently the rule, and abnormalities in this direction were the exception. Out of ten cases examined, four had post-normal occlusion. Of course in dealing with only ten cases the small number does not permit one to deduce facts of great statistical importance, but, in considering the difficulty of obtaining cases showing normal occlusion in modern English mouths, it is certainly striking that so high a percentage should be found in those of Maoris apparently selected at random. With reference to teeth lost by extraction I found that the total number was eight, of which three were first permanent molars.

Crowded arches would appear to be in the minority, since two show considerable crowding, one is V-shaped with crowded incisors, while one other is crowded on the left side only. The average age of these Maori soldiers is $23\frac{1}{2}$ years.

Having dealt with the Maori series, I next proceeded to investigate the twenty models of British colonists born in New Zealand. At once I was struck by the comparatively small and crowded arches. Some were V-shaped, very constricted and highly vaulted. These, however, were in the minority, the average palate in this series being V-shaped while the teeth were small.

The occlusion also affords a striking contrast to that of the Maori series. The average occlusion taken from ten cases is post-normal for these British mouths. Out of ten cases only two were normal to any degree, and both of these arches were crowded. I must here explain why I have given you figures for ten cases only in each series. I set out to obtain these details regarding occlusion only a few days ago, and on examining my British series I discovered that ten cases out of twenty possessed no lower models. I have been unable so far to discover what has happened to them, but as the College of Surgeons is a large place I hope to find them tucked away in some corner, probably for safety during recent spring cleaning.

As I have said, the palates which belong to these post-normal occlusions are usually U-shaped though the teeth are not always crowded. May it not be therefore that the shape of the palate is related to the type of occlusion? The number of teeth lost by extraction in ten cases is eighteen, of which four are first permanent molars. In one case, as you will see by the drawing I shall show you later, a left upper lateral is missing, and the canine has moved forward into the space. The degree of crowding is very marked

in comparison, since eight cases are affected in this manner. On the whole, third molars appear to be present, and, in the lower especially, crowded out of the arch.

The average age of this series is $25\frac{3}{4}$ years.

And now, having given you some idea of the general appearance of these Maori and British mouths, I should like to pass on to more concrete evidence in the shape of figures derived from a few very simple measurements. I must explain at this point that maxillary arches only have been measured, since my research investigations are at present confined to determining the shape, size and position of the palate. The measurements I am going to describe are five in number—more of course have been actually taken on these models, but I have selected these five as being most suitable for the purpose of this paper.

Briefly they are: Intercanine, interpremolar and intermolar, the measurements in each case being the greatest width between the buccal surfaces of these teeth. I should here explain that it is the second premolar and molar which is taken in this connection. Also the length of the palate, i.e. a line drawn from the mid point between the central incisors to the mid point of a line connecting the last molars.

The Area of the Palate.

As you will see by the diagrams I have prepared, an accurate drawing on squared millimetre paper makes this measurement quite easy to obtain. In passing I should like to mention my great indebtedness to Mr. Parfitt, whose apparatus I am using for this purpose.

The following table of average measurements for cases in each series will serve to show more clearly the differences between Maori and British which I endeavoured to explain earlier in my paper. The measurements are those I have just enumerated.

	Maori.	British.
Intercanine	40.8 mm.	38.8 mm.
Interpremolar ..	54.8 ,,	49.2 ,,
Intermolar	68 ,,	62.8 ,,
Length of palate ..	54 ,,	50.8 ,,
Area of palate ..	27 sq. cm.	25.3 sq. cm.

The figures for the intercanine measurements represent an average taken from nineteen cases in each series, while the remaining averages are taken from twenty cases. As you will notice, the Maori figures are greater than those of the British, and show respectively a difference of 2, 5.6, 5.2, and 4.8 mm., while the difference in area is 1.7 sq. cm.

So much then for actual figures. It is, however, interesting to visualise for a moment the general physique and build of the men from whom these casts were obtained. We may take it, I think, that judging by the figures I have quoted, the British-born New Zealand colonist will have much the same physique as the average Englishman living in this country. That is to say, he will be of medium height and build, with a rather long narrow face an orthognathous profile and a brachycephalic skull.

Now, in comparison, I will quote a passage from a book on New Zealand which I have been reading lately. It is written by Mr. Pember Reeves, an agent-general for New Zealand in 1899. He says :—

"They are as a rule tall and bulky, long-bodied and short-legged, and with fairly large pyramidal skulls showing well developed perceptive faculties. Their colour varies from maize to dusky olive, and their features from classic to negroid, but usually the nose, though not flat, is wide, and the mouth, though not blubber-lipped, is heavy and sensual."

This description of the general physique of the Maori agrees with the facts derived from a study of the twenty models I have described, and it would appear that other physical characteristics are as markedly different from those of the British as are their jaws and occlusion. It seems therefore to be important to study any type of mouth not as a separate entity but as part of the mechanism of the whole body, and that this view of the matter is being taken is evidenced by the valuable work done by our President, Mr. Friel, Sir A. Keith, Professor Brach, Mr. Campion, and others.

In conclusion, I must thank you for listening so patiently to my paper, and trust that I have made it clear how very interesting and fascinating a subject a study of measurements can be.

Discussion.

Mr. G. Northcroft wished to know why it was determined to use the buccal rather than the palatal measurements. It was very desirable to arrive at a standard method of measurement. He noticed that the author had described the measurements as inter-canine and inter-premolar. This seemed rather an unfortunate expression. He wished to draw attention to the unfortunate interpretations that might follow a loose use of terms, the same term conveying different ideas to different people. For example, the term "U-shaped arch" as used by the author was evidently intended to represent something entirely different from what he had always considered the U-shaped arch to be. It was unfortunate that such terms as "short," "broad," "U-shaped," "V-shaped," should be used at all, when people did not really know what was meant by those terms, and interpreted them according to their own ideas, and not according to some standard.

Mr. A. T. Pitts said that, without in the least questioning Miss George's diagnosis, he would like to ask what was her guide to ascertaining the post-normal occlusion, because, when one had models and knew nothing of the cases, it was difficult to be certain of the articulation. The models could be put together to make almost any degree of occlusion possible! He had no doubt that there were other points which guided the author in this respect, but he would have liked to have known more. He went on to ask whether she had noted that in these cases of post-normal occlusion in the Maori examples the third lower molars were present in good position. Mr. Dolamore had suggested that the actual size of the jaw might not be different in post-normal occlusion, but the speaker was rather inclined to think it was smaller. If so, then one might expect to find an impaction of the third molar in cases not treated. He would like to know whether the author had found the third molars present and in good position.

Mr. Levien said that the points brought out in the paper suggested to him a reason why the children's teeth and jaws in the case of the Maori were so much better shaped than the English. It came back to the same old question of food. He had often motored through

parts of New Zealand where the Maoris were populous, and the tiny children were to be seen eating Indian corn off the cob, actually biting it off, and using their jaws as nature intended them to be used. He believed that if a complete set of impressions could be taken the difference between the Maori and the British jaws would be brought out very clearly. The Maoris ate very little meat; they lived to a great extent on fish, especially shell fish, on green stuff and sweet potatoes which they grew themselves, and on hard foods generally. He entirely disagreed with some remarks on the subject made by Professor Pickerill. During his practice in New Zealand, for fifteen years, he saw a great deal of the Maoris in one way or another. The Maori, especially the young children and growing lads, did eat hard foods.

Mrs. R. LINDSAY said that she supposed that everyone knew of Mr. J. R. Mummery's investigation into Maori skulls—in 1870, she thought it was. Mr. Mummery measured about two hundred of them, taking the measurement across the palate between the first molars, and he found the inside measurement two and a half inches. She noticed that Professor Pickerill contended that the Maori did not chew their food very much, but, the food being soft and much cooked, swallowed it. She had heard that they gave five hours' cooking to their meat. She thought the author's evidence that evening seemed to corroborate that, because she said that there were very few signs of attrition on the Maori teeth, and this would bear out what Professor Pickerill said, that these people used their swallowing muscles and expanded their jaws in that way.

Mr. MAXWELL STEPHENS suggested that the truth of the matter with regard to the Maori might be that the children did eat hard food, but that after the jaws were developed the habit was to eat softer food.

Mr. CHAPMAN thanked Miss George for stepping into the breach and giving such an excellent paper. One thing about her paper which had struck him was that she had put into practice a method of representing the dental arches which Mr. J. B. Parfitt brought before them as recently as May last; it enabled the results of examinations of casts to be very rapidly and yet sufficiently and correctly demonstrated. He had only one question: he was not quite clear what she meant by some connection between the shape of the palate and the type of occlusion, whether she had in her mind the shape of the dental arch in comparison with other dental arches or a different type of occlusion.

Miss SMYTHE said that she had lately been doing some work on school children, and the results, like some of the inferences from the paper, were rather depressing. She had selected those who appeared to be fairly normal children, yet the proportion of normality was certainly not higher than one in six, and it was questioned whether under those circumstances she could adopt a standard of normality at all, or, rather, whether she should not accept as normal the condition shown in the majority of cases.

Mr. GEORGE THOMPSON pointed out that there were quite a number of British-born New Zealanders with very good jaws—jaws as good as those of the Maori. Professor Sir Arthur Keith had said that there was some danger of imagining that there were a great many more undeveloped jaws than was actually the case. On the contrary, there were a very great number of highly developed jaws; the others were degenerate. He disagreed with Professor Pickerill's suggestion that the Maori had soft food. In all these primitive races the children always had a good deal of hard food to bite and chew. As soon as they had teeth at all they took to chewing things. He believed that Maori children, after weaning, never touched milk. In this country as soon as children were weaned they were put on cows' milk. He protested against the idea that British-born people had degenerate jaws such as they had seen that evening. Quite 50 per cent., he

believed, had well-developed jaws up to a certain age. Of course, they neglected their teeth—that could not be denied. But the same kind of neglect or degeneration was to be witnessed among the Maori, whose teeth nowadays were beginning to go the same way as the British because they were now living on a more civilised diet.

The PRESIDENT said, with regard to depressing statistics, that in his own experience he did not regard the examination of children's teeth as very depressing, because he had been able to get about fifty sets of models out of three hundred that approached normal occlusion. Perhaps, therefore, we were not so degenerate as the statistics suggested. The thing which had made him feel that the Maori did not chew quite as hard as, for instance, the Eskimo, was the want of attrition and the great overbite. In most of the races which seemed to do very vigorous chewing the cusps appeared to be worn down, and there was an edge to edge incisor bite. The other day he saw a skull belonging to the extinct Tasmanian race, where there was excellent occlusion, but it was edge to edge, and the cusps were greatly worn down. He congratulated the author on her paper, and thanked her for the trouble she had taken in working out these diagrams. In some ways it was rather a depressing paper, and might suggest that the British race was degenerate.

Miss GEORGE thanked the members for the kind things they had said about the paper. It was a great undertaking for her, but was made much easier by the patience of her audience. Mr. Northcroft had asked why the buccal surfaces had been taken. She must explain that the method of measurement adopted was not her own invention. It was brought forward mainly by Mr. Norman Bennett. By taking the buccal surfaces one got the maximum width, which was not the case if the measurements between the palatal surfaces were taken. She quite agreed with the strictures upon the loose use of terms, but she was afraid the terminology employed in the paper was the best she could do under the circumstances; she had only a fortnight in which to prepare the paper. She would be very pleased if anyone could suggest an alternative term for inter-canine and also for U-shaped arches. The latter was her own term, and certainly was not a good one, although the best she could think of at the moment. Mr. Pitts had mentioned post-normal occlusion. In her diagnosis of post-normal occlusion there were certainly one or two cases which were doubtful, but on the whole they represented what she understood by post-normal occlusion, and she was afraid she could not explain it further in words, though she could point it out on the model. She had been asked whether the third lower molars were present in the normal Maori mouth. So far as she remembered they were more often present in the Maori series than in the British. She had been interested in the discussion on the food the Maori ate. It would have meant a much longer paper if she had gone into that question, but it interested her at the time, and she had tried to discover the truth of the matter, without, however, arriving at much satisfactory information. There was no doubt that they did eat fairly hard food like corn off the cob. Mrs. Lindsay also had mentioned this question of food, and she was interested in the point Mrs. Lindsay had raised about Mr. J. R. Mummery's investigations. Mr. Chapman had mentioned the relation of the shape of the palate to the type of occlusion. What she had meant to say was that where one got a normal occlusion one got a differently shaped palate from that which went with the post-normal. She was also interested to hear Mr. George Thompson's remark that the New Zealand colonist had just as well-developed jaws as the Maori. She quite agreed about that, because, as she had tried to explain, she had only taken twenty cases. These were taken quite at random, she had no history, the casts were simply sent from New Zealand, and she did not know where or why they were picked up. As far as she knew they were just taken from these soldiers in a

haphazard way. Therefore she could found on them no general conclusions with regard to New Zealand colonists, who, together with men of the English race in general, might have just as normal jaws as primitive races like the Maori. She did not want to make any definite distinction between the two, but simply to confine her conclusions to the few examples in each category with which she had had to deal. The President had mentioned the absence of attrition. It was very noticeable that there was no attrition in these Maori models, but then, she would not like to be too definite about that, because models had a habit of getting knocked about. Again she thanked the Society for its kind reception of her paper.

Casual Communications by E. Sheldon Friel.

(1) "A Case of Lip-sucking and its Treatment."
(2) "A Case of Abnormally Large Centrals."

Mr. Friel said that the first case was that of a small boy aged $3\frac{1}{2}$ years who sucked his lower lip. His parents made every effort to stop him. Eventually he (Mr. Friel) made a mouth-breathing sheath to go round the front of his mouth, and this he wore at night. He showed models made at the time, and six months later. The second case, of which he also had models, was one in which all the teeth were abnormally large. This was the case of a child whose mother (he was unable to examine the father) also had teeth which were practically the maximum size. The boy's were 2 mm. over the maximum.

Mr. A. T. Pitts remarked that it used to be stated that a child had teeth from the father and merely jaws from the mother, and that was scoffed at a good deal. In a broader sense it must be true that the teeth and the jaws might be inherited quite separately, although not immediately from either parent. Statistical investigation would be useful, although difficult. No doubt in this boy's case there was insufficient room for laterals, and that inherited condition would be the cause of malocclusion.

Mr. Friel, in reply to a question, said that the exact width of the larger of the two incisors was 12.2 mm. and of the other 11.9. The maximum normally was 10 mm. and the average 9 mm. All the teeth he measured were over the maximum.

Mr. Harold Chapman asked whether any measurements had been taken of the boy's face.

Mr. Friel said that he had taken Mr. Campion's averages as a standard, and all the boy's measurements practically were plus, but he was certainly within the limits of variation that Mr. Campion gave. The boy was quite healthy; most of his muscles were good, and his weight was over the average.

British Society for Study of Orthodontics.

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1st May, 1925.

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